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FUTURE CITIZENS

COMPULSORY education for a population of thirty crores is the gigantic enterprise framed by the Sargent Scheme, short name of the plan for post-war Indian educational development laid by the Central Advisory Board of Education, whose report thereon was released last March. It will not be an exaggeration to say that if this plan can be made operative, the result will be a New India, fitted to assume the burden of world responsibility to which she is entitled by history, numbers, natural resources and the genius of her people. The difficulties of accomplishment are great, and the effort demanded by their solution enormous: but they must be surmounted if India is to take her proper place among cultivated and progressive nations.

A bare outline of the plan will facilitate its consideration. Pre-primary, conveniently called nursery education, will begin at age 3 and remain voluntary until 6, at which the compulsory system begins with junior basic (primary) school until age 11 followed by senior basic (middle) school until 14. Dovetailed with basic will be the high school whose course should cover 6 years, normally beginning at age 11 for only those pupils who show promise of benefiting fully by the opportunities provided; and preparation being made for at least one child in every five of the appropriate age-group. There follows the university, conditions of admission to which will be adapted to ensuring entrants' capability of profiting by the classes. It is contemplated that ultimately the intermediate course will be merged in high school, when the minimum degree course will be 3 years; meanwhile, only the first year will be transferred to high school, the second year being taken at the university. Finally, provision is made for technical, commercial and art education, for adult education and for training of teachers.

This last item is the most important, numerically and vocationally. The proposed national system outlined above will require 20 lakhs of teaching non-graduates for schools of all types with 1,80,000 graduates for teaching the high schools; and as existing institutions are barely sufficient for repairing wastage, and training new teachers for the present system, abundant new training schools and colleges will be needed. It is intended that suitable boys and girls be selected as the close of high schooling approaches, and that the training be free, with liberal assistance for the maintenance of poorer scholars. It cannot be too strongly emphasised that the determining factor in any system of education is the teacher, and no trouble must be spared in recruiting young men and women with vocational urge to spread knowledge and build character among their junior compatriots.

Such young people having been discovered and trained they must be properly paid. The current remuneration of teachers is disgraceful, and is explicable only on the assumption that authorities responsible do not regard education as a service of any real public importance. The average pay of primary teachers in government schools is Rs. 27 per mensem, and in private schools is generally lower, one large province averaging Rs. 10. The Board has naturally found some difficulty in assessing appropriate new scales owing to the artificial rise in living cost: but whatever the final amounts may be, they must be sufficient to range the teacher in a social stratum commensurate with the high responsibility of his task. No nation has yet had the courage to be logical in the order of payment, and award the largest salaries to the elementary teachers because their influence on the pupils for good or evil is the greatest; and it would perhaps be unreasonable to expect the Board to have taken this plunge.

From the foregoing it follows that the age-limits of compulsion will be 6 and 14. This period of education without any charge to the

parents is considered sufficient to equip the pupils for citizenship provided the training of character proceeds conjointly with training of intellect at every stage. There is great scope for improvement in both fields. An overall illiteracy of 85 per cent. is a ragged garment for democracy, and would bode ill for this country if that form of government is finally adopted. Citizenship has been usefully defined as an activity of the personality to secure certain benefits for the community to which the citizen belongs, and its proper exercise involves such qualities of character as consideration for others, commonsense and self-discipline. That these are sadly lacking is apparent in many little ways, notably the misuse of roads, where animals wander and children play while bicycles dart here and there regardless of rules; and controllers of the slowest traffic have no compunction in occupying the middle. It is noteworthy that in Travancore, with an overall 45 percentage of literacy (56 for men; 34 for women), these abuses are not observable.

The Board urges encouragement of games and physical exercise, wisely too, because games promote self-discipline and consideration for others by developing corporate action. People accustomed to playing games and watching others play them do not require to be queued at the entrance and the railway ticket office: they queue themselves instinctively, thereby saving each other limitless exasperation and inequitable treatment. They gradually learn that the disabilities under which we writhe, and which we sometimes rather monotonously bemoan, may be less owing to dominant institutions and forms of government than to our own deficiencies of intellect or temperament. Even in such game-loving countries as England and the United States, however, consideration for others remains elusive, as witnessed by the 1937 coronation bus-strike in England, and the pre-invasion coal-strikes in both countries, heartless tyrannies of organised labour endangering those liberties—including their own—for which the cream of humanity is being sacrificed. It follows that even among nations practising compulsory education, this is ineffectual to promote citizenship unless accompanied by change of heart.

These remarks draw sharp distinction between education and instruction. The young gentlemen of respectable appearance who hold committee meetings leaning against their bicycles in the middle of the road may have been instructed and perhaps have taken a university degree; but they have not been educated. The busmen have been instructed in motor mechanics, and the miners in coal-getting; but they have not been educated. It may not be amiss here to mention a useful factor in self-education, the pursuit of a hobby. However primitive in operation, wood-carving, flower-pressing, silkworm-tending, stamp-collecting and butterfly or moth-catching, all accompanied by essay-writing to describe results, are not merely interesting relaxations, but may become the means of revealing some latent bent or skill, and thus lead to that most enviable of goals, namely, intrinsic enjoyment of the occupation by which you earn a living. Moreover, they promote habits of systematic arrangement, attention to detail, and tidiness which may be trusted to bear useful fruit in the ordinary commerce of daily life.

Equally with the new British Education Bill made public on 16th December 1943, the Board recommends basing the children's early training on religious principles, always in conformity with parents' own beliefs. Child psychology needs the idea of a super-parental authority, but there should be a minimum of complicated ritual or theology. In fact, if only the world had accepted and implemented the simple injunction "Do unto others as you would they should do unto you", history would have remained innocent of those wars and revolutions that have blackened its pages during 1,900 years.

If the Sargent Scheme were to accomplish nothing beyond inculcation of citizenship, i.e., consideration for others, commonsense and self-discipline, it will offer a handsome return for the huge ultimate annual cost around 300 crores of rupees. It is reasonable to expect, however, that the process of selection involved in its application to Indian youth will reveal hidden talent and latent genius now lost in the morass of general ignorance. The Board's proposals for technical, commercial and art education should then yield a rich harvest, having been meanwhile tested with existing material. In this connection it is curious to note that the Board seems oblivious to the existence of the Indian Institute of Science, Bangalore, perhaps because only one of the forty-one distinguished Board Members has been actively associated with it. This is typical of government compartmentality. Referring to the sandwich system the Board advises (p. 42) that "the adoption of such a system would be of particular value to India", evidently unaware of its having flourished in this country during thirty years past. It was introduced by the late Dr. Alfred Hay and continued by Prof. J. K. Catterson-Smith, to the lasting benefit of students in the department of Electrical Technology, Indian Institute of Science; from which, for instance, over 90 per cent. of the technical radio-personnel of Indian broadcasting have sprung. It would not diminish the authority of the Board if the Director of the Institute, *ex-officio*, were admitted to membership.

From another standpoint also this is desirable. One of the late Sir Dorabji Tata's aims in founding the Institute was to secure the training of post-graduates in methods of research; but the only practical reference by the Board to this activity is to mention (p. 35) "the importance of establishing a high standard of post-graduate studies and particularly in pure and applied research". The sentence effects a condensation positively Kiplingesque, and casual readers of the report cannot be expected to grasp its implication: which is, that unless a citizen has acquired by training, or is otherwise happily endowed with a research attitude of mind he is at the mercy of any smooth-tongued personage, commercial or political, who may regard him as legitimate prey.

The practice of weighing evidence, balancing opinions and mistrusting slogans is urgently needed in this country, particularly among the young, whose generous enthusiasms tend to misdirect their activities unless controlled by the research spirit. If democracy becomes the final form of Indian government it will surely founder unless the habit of inquiry becomes more widely diffused; and probably this aspect of research is even more important to India than its potentialities as a dividend-payer.

Among the most interesting chapters of the report is that on adult education, which it is proposed to launch in the sixth year of the programme, thus allowing for initial planning and for assemblage of competent teachers: itself a problem evidently viewed with some apprehension by the Board because they consider tact, understanding and ability to be required in higher degree for teaching adults than for teaching children. This is the old heresy on which the underpayment of elementary teachers is based, and the Board must be calculating on a hitherto unsuspected missionary zeal among the prospective instructors if remuneration is to be only Re. 1 per hour for a class of 25 illiterates. When the existing 9 crores of illiterates have been liquidated by these exertions, adult education proper will become the principal activity of this department, supported by visual and mechanical aids such as the cinema, gramophone and radio. "Dancing, particularly folk-dancing, music both vocal and instrumental, and drama will also be useful, but not only as pleasant accomplishments in themselves as well as recreative activities, but also as helping to attract and stimulate adult students." This may sound frolicsome to many, who will doubt whether these delights can be achieved by those adults who do not already possess a strong urge to self-education.

Returning for a moment to fundamentals, it may be worth while to recall some words of J. A. Froude: "I accept without qualification the first principle of our forefathers, that every boy born into the world should be put in the way of maintaining himself in honest independence. No education which does not make this its first aim is worth anything at all. A tree must be rooted in the soil before it can bear flowers and fruit. A man must learn to stand upright upon his own feet, to respect himself, to be independent of charity or accident. It is on this basis only that any superstructure of intellectual cultivation worth having can possibly be built."

Concluding chapters of the report deal with training of teachers, health of the school child, education of the handicapped, recreative activities, and employment bureaux. Recommendations on these and the foregoing sections are based on the reports of eight committees appointed since 1935. The conclusions now published represent an earnest, informed and enlightened attempt to provide a workable plan for the future education of Indian youth, and the Board merit the gratitude of all right-minded citizens for their labours. The Hon'ble Sardar Sir Jogendra Singh (*Chairman*), Mr. John Sargent (*Educational Adviser to the Government of India*) and their 39 colleagues are to be congratulated on having produced a deeply interesting report and the framework of a beneficent educational revolution. Thomas Jefferson, who wrote (1776) the declaration of American Independence, also wrote (1786): "I think by far the most important bill in the whole code is that for the diffusion of knowledge among the people. No other sure foundation can be devised for the preservation of freedom and happiness." Lovers of this country, whether Indian or British, will devoutly hope that these brave words may find fulfilment in the Sargent Scheme.

M. O. F.

SIR CLARENCE A. BIRD, K.C.I.E., C.B., D.S.O.

Master-General of Ordnance in India, and Chairman of the Supply Development Committee, GHQ (India)

THE retirement of Sir Clarence Bird will be deeply regretted in this country. He is a great patron of science and scientific men. During his regime, the scientific organizations in the Ordnance Branch expanded enormously. Science was called in more and more to aid the war effort. The assistance of scientific and technological institutions in the country was sought to deal with a variety of problems ranging from the manufacture of fine chemicals to development or modification of stores and equipment, their production and storage under tropical conditions, etc.

In 1942, Sir Clarence sponsored the Basic Chemicals Committee formed by the War Department under the Chairmanship of Brigadier R. D. T. Woolfe and with a distinguished membership of scientists, technologists, and industrialists. This Committee's report brought out the gaps which existed in this country's basic chemicals production to meet fully the defence as well as the civil requirements. Sir Clarence gave not only an impetus but spared also no efforts to expand the chemical industry, particularly heavy chemicals and coal tar and its distillation products by persuasion, and where necessary, by judicious pressure.

Being a great engineer himself, Sir Clarence has devoted his attention to the planning and establishment of a sound system of technical education particularly from the point of view of providing an adequate flow of technical recruits for the army both officers and other ranks.

Dignified and amiable, Sir Clarence represents the best type of Englishman. His kindly and genial temperament, humour, unfailing courtsey, readiness to help, tact to handle difficult situations and sense of justice have won the admiration of all those who had the privilege of coming in contact with him.

THE TENTH PAVLOV CONFERENCE*

THE tenth Pavlov Conference on physiological problems was held in Moscow from 29th March to 2nd April under the Chairmanship of Academician Leon Orbeli, Vice-President, Academy of Sciences, U.S.S.R. The Conference was organised by the Biology Section of the Academy.

Unfortunately all Pavlov's pupils were not able to attend as they did the previous conferences in order to discuss their work and achievements on the analysis of the Master's heritage. Nevertheless, the Conference became a kind of a congress of physiologists.

Some fifty papers were presented at the Conference. This was the first conference since the war began. In general the Conference was called to exchange experiences of physiologists who have turned their study to pathophysiological problems since war began because of the material presented by war injuries to the nervous system. In this way physiologists have been able to work for the benefit of their country by seeking means to promote rapid treatment and cure of the wounds and at the same time have accumulated much new data and enriched the science of neural physiology.

Deserving of special attention are the papers read by Professors P. K. A. Nokhin, A. R. Lurye, N. I. Graschenkov, T. P. Mayorov, V. V. Stroganov, and scientific workers V. V. Pavlov and E. E. M. Sosuntsova. During their observations and experiments on patients physiologists have discovered a number of new facts and have been able to give already known facts a physiological interpretation. In this respect special interest was aroused by the paper read by Professor P. K. A. Nokhin on distribution of higher nervous activity in dogs following the removal of the frontal part of the brain cortex, and the paper which followed immediately after it was read by Professor A. R. Lurye on nervous disorders following injuries to the frontal part cortex in man. The former showed by means of combined motor and secretor methods that removal of frontal sections of cortex, while it left secretor and simple motor reactions untouched, made itself felt, in fact, that it was impossible to stop motion, forming part of complex action once it had been started. The latter showed in a number of patients the impossibility of stopping movement and disruption.

In addition to purely physiological interpretations some speakers at the Conference were able to give details of the excellent results of the therapeutic measures they had adopted, for example, in curing deaf-mutism resulting from concussion (90 per cent. cures, Professor A. G. Ivanov Smolensky), and work on new methods of diagnosis of diseases of cerebellum (M. B. Tetyeeva and Peed Yankovskaya).

Great interest especially on the interpretation data obtained was shown in the paper read by Prof. V. K. Petrova, an old colleague of Pavlov who is now seventy years of age. She has worked on the dogs for fifteen years subjecting some to various nerve traumas and carefully guarding others against any sort of nerve injury. Professor Petrova noted that dogs suffering from nervous injuries have all grown decrepit while healthy dogs still look comparatively young, that they did not show grey hairs, bald spots and affected teeth. The former in addition also suffer from skin diseases and cancer-like tumors.

Dr. M. I. Livanov who is continuing Pavlov's work on conditioned reflexes has obtained these reflexes from changes in electrical activity of brain cortex; Professor Y. P. Frolov, also continuing Pavlov's work has obtained conditioned reflexes from muscular contraction in lungs of tortoises.

Work on unconditioned reflexes and instincts was detailed in papers by Professors S. A. Vassiliev, A. A. Mashkovtsev and V. Krushinsky. Vassiliev gave experimental explanation for the mechanism which causes birds to take dust-baths and showed that birds which have been deprived of their voices continue to perform all actions necessary when singing as though voice were still functioning. Professor Mashkovtsev gave the Conference excellent results of his work on the decrease in percentage of barrenness amongst domestic animals; Krushinsky showed that difference between wildness and tameness in grey and white rats depends to a considerable extent on development.

Amongst other papers read were those by Professor G. B. Gershun who showed that when patient is unconscious resulting from concussion, and exciters continue to affect the central nervous system and are reflected in electrical impulses in brain cortex but do not affect consciousness of patient; by L. S. Gdrshelva who showed that absence of cerebral hemispheres in doves leads to birds being considerably less affected by carbon dioxide poisoning than is the case in normal birds; by M. I. Saprokhin who showed convincingly that not only cerebellum affects vegetative nervous system but that vegetative nervous system also affects cerebellum.

Great interest was also displayed in work of those who were at the Conference and who are not amongst actual pupils of Pavlov: Academician L. S. Stern, Professors H. S. Koshtoyants and N. I. Grashchenkov, both corresponding members of the Academy, and Professors M. M. Zevadovsko, E. B. Balsky, A. A. Magnitsky; S. D. Klencharev, leading Therapeutist and R. Lurye, Physiologist.

* Proceedings of the Conference on Physiological Problems dedicated to the memory of Ivan Pavlov, cabled by the Soviet Scientists' Antifascist Committee for publication in *Current Science*.

CHEMOPROPHYLAXIS IN MALARIA

By U. P. BASU, D.Sc., P.R.S.

(The Bengal Immunity Research Laboratory, Calcutta)

MALARIA, the most widespread of all the diseases prevalent in India, causes the greatest amount of morbidity and mortality in the country. The number of individuals that suffer from malaria every year, has been estimated at a minimum of 100,000,000 amongst which nearly one million die of it per year. For the interests of public welfare as well as for the general development of the country attention should be directed to the prevention of the disease in individuals. The growth of *Anopheles* mosquito that is responsible for the spread of malarial infection must be checked. This may be done by destroying the breeding centres and by killing the adult stage of the mosquito. Of course, there would take time to materialise. A chemoprophylaxis might then be a better method for controlling the infection throughout the length and breadth of the country.

Quinine is the common antimalarial and is in general use. But it must be taken in doses that would relieve symptoms. Taking this at a minimum of 45 grains, a rough approximation of the annual requirement for India would be ($100,000,000 \times 45$) grains, or, approximately more than 6,00,000 lbs. The average production in India, however, comes to about 90,000 lbs. To this we may add the amount which India imports every year. This on average is found to be 1,10,000 lbs. per year before the war. It thus appears that the consumption of this antimalarial is at best one-third the estimated requirement. From the report of Wilson and Mirchandani on the prospects of cinchona cultivation in India, it may be found that there are enough suitable land in India for cinchona plantation to meet the total requirement of quinine. It is difficult to understand why plantations are still not being started on an extensive scale. The cinchona plants take some years to mature and the maximum content of the alkaloid occurs in trees between the ages of seven and eleven years. In spite of new plantations which might immediately be started, we would have to depend on the imported quinine for years to come. But even then it is difficult to meet the heavy demand of the country with imported quinine from abroad, as the world production of quinine is believed not to exceed 2,000,000 lbs.—Java alone supplying 90 per cent. of the above production. However, when this most valuable remedy in controlling the disease in man, is not yet available in sufficient quantities, we should search for other remedies to eliminate this evil.

It may be noted that in spite of the various measures such as destroying the larval stage of the mosquito by Paris Green or some oil, killing the adults by insecticide, or, protecting the human beings by administration of antimalarials, malaria as a disease is not diminishing to any extent. On the contrary in wartime its fury further increases in virulence. As no immuno-therapy is possible in the treatment of malaria, the most promising line of attack would be by means of chemotherapy. It would have been ideal if a compound would have been available that might have prevented the inception of an infection when a man has been bitten by an infected mosquito. No such compound is yet known and as such a true prophylactic measure cannot be followed.

The next step would be to attack and destroy the malaria parasite in the various stages of development in the human body. Quinine as well as certain synthetic acridine derivatives (Atebrin, Atabrine, Mepacrine or Alecrin) remove schizonts from circulation. But these have no effect on gametes. The drug plasmochin—a quinoline compound is the only gametocide in vogue. Similar other quinoline derivative is also now being found to exert a definite and often better gametocidal action. In spite of treatment with one or other antimalarial drug, some parasites are left in the body mechanism and may reappear in the peripheral circulation causing a relapse at a subsequent interval; *P. falciparum* (tropical malaria) persists after an attack for a year only, the *P. vivax* for two and half years and the *P. malariæ* upto seven years. So the problem in the treatment of malarial patients, would be to find out a therapeutic agent that would destroy the parasites that might have entered into the fixed tissues (probably the reticulo-endothelial cells) and thereby lower down the cause of relapses. Naturally, what is wanted for true chemoprophylaxis is a drug that would act equally on all the above stages of the parasite, or, at least a drug that would prohibit the inception of a malarial infection. It should, of course, be less toxic, more active, readily produced and easily available to the mass. Under these circumstances then, the menace in question be removed or at best checked to a considerable extent.

As it stands at present, there is no drug to prevent infection. Quinine and Atebrin like compounds, however, are good schizonticides, and as such, are in heavy demand. The rate of production of quinine and its availability in India, as indicated above, cannot satisfy India's requirements. The only other immediate remedy lies in the production of the synthetic schizonticides. It is now well known how these can be produced. The most important chemicals required, are toluene, benzene, acetone, acetic acid, nitric acid, hydrobromic acid, alkalies, fusel oil, chloroform, benzene, phosphorous oxychloride, thionyl chloride, chlorine, metallic sodium and diethylamino ethanol (or, simple diethylamine). There is no secrecy in the mode of production and every one can produce it. The point is how to obtain the product in quantities to meet India's demands. As 1·5 gram of this antimalarial is required for one course of the treatment, 100,000,000 sufferers in India would require roughly 3,500,000 lbs. To achieve this production our chemical industries would have to supply all the above chemicals costing many

million pounds. Certain of these chemicals, of course, would be easily available, some like toluene, benzene, acetone, fusel oil, etc., are being produced, but on account of Government control their supply is restricted. Metallic sodium, phosphorous oxychloride, thionyl chloride and diethylamino ethyl alcohol are not available at the present moment and have to be imported from abroad. The full requirement for India would necessitate the purchase of 3,150, 4,000, 7,470 and 4,000 cwts. respectively of metallic sodium, phosphorous oxychloride, thionyl chloride, and diethylamino ethyl alcohol approximately. Previously America too synthesized the antimalarial from intermediates imported from Germany. If the start that has already been made in India be encouraged, there is no reason to believe why in very near future India would not be able to satisfy her own requirements by manufacturing all the materials that are necessary within the country itself.

It is quite natural and possible that by producing the synthetic antimalarials and cultivating the cinchona plants wherever possible, we can supply enough materials for suppressing the malarial attack in every part of the country. In the meantime extensive investigations and co-operative research may be carried out throughout the various research institutes to find out a sporozoiticide that would be a true prophylactic, and prevent malarial infection in future.

FORECASTING AND ESTIMATION OF CROP YIELDS

By V. G. PANSE[1] and R. J. KALAMKAR[2]

FORECASTS and estimates of yield of commercial crops like cotton, jute or sugarcane are of considerable importance to the trade and industry, because the availability of raw materials during the season is the basis of all calculations of manufacturing processes. With the increasing emphasis on 'planned' production, a still greater value will come to be attached to reliable estimates of yield, while in an emergency, like the present, arising out of war conditions, accurate forecasts and estimates of production are a paramount need for ensuring sufficiency of food grains and their equitable distribution in different areas. In India, where tax on agricultural land forms the principal source of Government revenue, the Government administration is specially interested in forecasting and estimation of crop yields.

Forecasts or estimates of most probable production are made while the crop is still standing in the field, whereas the actual production is estimated at or soon after harvest. The latter may be treated as a more accurate forecast concerning the movement and arrival of the crop to the market during the season. Estimation of production involves a knowledge both of the average yield per acre and of the total acreage sown with the crop. In England and the United States of America crop forecasts are made by a large number of voluntary reporters who are in close touch with the farming of their respective areas. In America, crop reporters are required to estimate both the yield per acre and the acreage under the crop; but in England acreage figures are obtainable precisely, since compulsory returns for all holdings are made to crop reporters. Except in permanently settled districts, an elaborate Government organization extending to the remotest village looks after crop forecasting in India. Each village has a *patwari* or an accountant who is also the crop reporter. His estimate of seasonal yield is usually expressed as a fraction of the normal yield; a method similar to that adopted in America. Acreage figures are recorded in the village register, which contains a list of all fields in the village, their dimensions and areas sown in each field with different crops each season. Area figures for different crops are consequently known with a high degree of accuracy.

The chief defect of the present methods of forecasting yield in India as well as in other countries is that no objective procedure is employed in arriving at the estimates which are merely opinions of individuals as to what the yield is. The normal yield, which forms the basis, has no precise definition. In America it is understood to represent yield better than the average but less than the maximum. In India, a certain number of crop cutting experiments are conducted on selected plots of land; but a straight average of these experiments is not taken as the normal yield. The figure adopted is based on selected results coupled with local information and opinions of revenue officials. In the absence of accurate estimates of final yield it is usually impossible to judge how closely the forecasts represent true yield. For commercial crops, independent data relating to yield are available through records of arrivals in markets or at factories; but these are ordinarily far too incomplete to provide an effective check on the forecast estimates. For grain crops even this information is lacking. It is frequently argued that the judgment of a skilled and experienced observer regarding average yield cannot be much wrong; but this contention has not been borne out whenever it has been put to a test (Yates, 1936; Irwin, 1938). Yates (1936) has given interesting examples of how forecasts based on a casual inspection of the crop can go badly wrong, and how biased results are produced either by attempting to choose deliberately an average sample or by omitting to follow an objective procedure in sampling. Agreement between different observers is no guarantee that the estimate represents the true average closely. All or majority of them may systematically under or over-estimate it. This bias can be allowed for only if its magnitude and direction can be shown to be fairly constant.

1. Institute of Plant Industry, Indore. 2. Department of Agriculture, Central Provinces.

To be of any real service, both forecasts and estimates of yield must be free from bias and largely free from accidental errors to which all estimates are subject. The efficiency of present methods of crop estimation in this respect needs testing, and the employment of objective procedures for this purpose, if not for replacing present methods altogether, are attracting increasing attention of Government departments concerned everywhere. To secure unbiased estimates, random sampling, which gives every member of the population an equal chance to contribute to the estimate, is the only known method available, and if the sampling is sufficiently extensive, accidental errors can be reduced to any desired level. Estimation of crop yield at harvest falls very properly within the realm of application of this kind of sampling. The problem of forecasting can be dealt with by the same method, though estimation is rendered more difficult here, because it must be based only on measurable characters of the standing crop. The underlying statistical theory is simple and is explained in considerable detail by Cochran (1939) in relation to the present subject.

Recent attempts to determine the yield of wheat in several districts of Great Britain and in a portion of North Dacota State in the United States by harvesting and weighing small samples of the crop in randomly selected fields are described by Cochran (1939) and by King and Jebe (1940) respectively. Due probably to the preliminary nature of the experiment, farms were not selected at random in England, while in North Dacota, a perfectly random selection of fields was considered impracticable and route sampling was adopted as a substitute. The unbiased character of the resulting estimate of yield and the validity of its sampling errors thus become suspect due to these deviations from strict randomization in both the cases; but nonetheless these surveys provide excellent illustrations of the application of the principle to the commercial crop.

In India, difficulties of adopting full randomization, whatever their nature and extent in America and England, are not insuperable, thanks chiefly to the existence of the Government land revenue machinery. A recent noteworthy attempt to employ this procedure in a large-scale agricultural survey is due to Mahalanobis (1939, 1942), who applied it to the problem of estimating the annual area under jute in Bengal, where due to the Permanent Settlement no village staff is available to carry out complete enumeration of area under different crops, a practice which prevails in other provinces. In devising a suitable sampling technique, Mahalanobis is primarily concerned with the evaluation of the relationship between the size of sampling unit and variance between samples, and through field as well as laboratory sampling he devises an empirical function which he terms the variance function analogous to one shown by Fairfield Smith (1938) from uniformity trials. A second similar relationship, the cost function, is further worked out between cost on the one hand and variance and size and density of samples on the other. He proposes to employ the same approach to the problem of estimating yield, though actual results of any such project do not appear to have been published yet.

This method, though interesting mathematically, appears to be of limited utility in connection with the practical problem of sampling for estimation of yield. Exploratory surveys are needed to ascertain the form of the cost and variance functions and to find the numerical values of the statistical constants of these functions. This creates an impression in the minds of administrators and other laymen that complex, time-consuming and expensive research is necessary before practical recommendations can be made about the sampling procedure to be followed. In the jute area survey, preliminary work covering an area of some 2,300 sq. miles, or rather less than the size of one revenue district, involved an expenditure of 155 thousand rupees in a period of three years and an actual survey of all districts growing jute, with a total area of 59,000 sq. miles, cost the same amount of money in one season. The cost in either case was equally divided between field work and statistical analysis. Since the level and variability of crop yields change from season to season and from tract to tract owing to the influence of various environmental factors, it cannot be expected that the variance and cost functions determined from sample data over a restricted area will predict with any great exactness the optimum type of sampling for different tracts and in different seasons (H.O.H., 1941). Estimates of cost based on these functions are not likely to be realized even approximately in practice, when it is considered that the field work on the recommended plan will ultimately be in the hands of the permanently employed revenue and agricultural staff. This condition also implies that a simple and uniform procedure will be highly advantageous. The utility of these functions in providing guidance in sampling for yield estimation will thus not be commensurate with the time and money spent in investigating them.

In fact, if objective methods of crop estimation are to be introduced in India without further delay, we must not place an undue emphasis on the matter of 'technique'. For adopting random selection of sample plots, which is the main feature of such methods, no investigation is required. It is really a question of convincing the Government departments concerned that replacement of the present personal selection of plots by a random selection is both essential and feasible. The optimum intensity and distribution of the sample plots in relation to the particular standard of accuracy desired for the final estimates of yield will, however, have to be determined by experiment. The effect of size and pattern of the sampling unit on the accuracy of the final estimate is of a secondary importance, as the sampling error from this source is only one of the components of error to which the estimate is subject. Commonsense consideration and past experience indicate that the magnitude of this sampling error will be small compared to variation from other causes. Crop estimating surveys can be planned in such a

manner that while the primary objective of estimating yield in the region surveyed is achieved with a known degree of precision, information calculated to increase the efficiency of future surveys both with regard to statistical accuracy and cost is also secured simultaneously. The aim should, of course, be to obtain estimates of yield with the requisite level of accuracy at minimum cost, but progress in this direction will be ensured on the basis of extensive observations made through successive surveys, rather than as a result of special preliminary inquiries in restricted areas. The principle is illustrated below by a brief description of the survey carried out in the year 1942-43 for estimating the yield of cotton in Akola District in Central Provinces. The experiment cost a moderate sum of Rs. 6,000.

The District has an area of 4,092 sq. miles and contains 1,734 villages. It is divided into six administrative subdivisions (*tahsils*). The total area of some 600,000 acres under cotton is distributed among the six *tahsils*, ranging between 69,000 and 137,000 acres per *tahsil*. The number of villages in one *tahsil* ranges from 186 to 348. Cotton is grown in all villages and it is ordinary *Oomra* (*G. arboreum* var. *neglectum* forma *bengalensis*) or its superior strains, Verum 434 and Jarilla. The crop is sown in June on the commencement of the monsoon and is harvested from November to February in five or six pickings. The plan of the experiment was as follows.

In each *tahsil* ten random villages were selected and from a list containing survey numbers of all fields growing cotton in the selected villages in 1942-43, two random fields were selected in each village. In each of these two fields, two plots measuring 81 ft. × 162 ft. = $^3/_{10}$ acre were randomly located. Random selection of villages, fields and location of plots was made with the help of Tippet's random numbers (1927). For harvesting, each plot was subdivided into six longitudinal sections of $^1/_{20}$ acre size. Yield data of 240 subplots in each *tahsil* or 1,440 plots in the whole District were thus obtained. Besides the *kapas* (seed-cotton) yield of the individual sub-plots, the number of plants, the number of bolls per plant and boll weight were also recorded in small sample units in one of the two experimental fields in each village. The analysis of variance of plot yields (sum of six $^1/_{20}$ acre sections) in each *tahsil* pooled over the whole District is shown below.

Analysis of variance of plot yields

Due to	Degrees of freedom	Mean sq.
Villages	54	1595
Fields	60	1150
Plots	120	154

While the magnitude of variation differed in the individual *tahsils*, the relative magnitude of variation from the three sources was more or less similar in most *tahsils*. It should be noted that the mean squares for the fields and villages in the analysis of variance include, besides the real variation due to these items, the sampling variation, since the yields of fields were measured only by sample plot yields, and village yields were based on those of a few randomly selected fields in each village. The real variation between villages is represented by the excess of the mean square for villages over that for fields, and the difference between the mean squares for fields and plots provides an estimate of the real variation due to fields. We thus see that variation from field to field is clearly the most dominant factor affecting the mean yield of a *tahsil*. There is a certain amount of additional variation due to differences between villages; but compared to these two factors, variation between plots in the same field is very small. This relationship between the three variances forms the basis for devising a sampling technique capable of giving yield estimates with a desired degree of accuracy. It is clear from the analysis of variance that the precision of mean yield will depend most on the number of fields sampled and least on the number of plots laid out in each field. Statistically the standard error of the mean yield is related to the variances from the three sources by the formula,

$$Vm = \frac{V}{n} + \frac{F}{nk} + \frac{P}{Nnk},$$

where Vm is the desired variance of square of the standard error of the mean yield, V, F and P the true variances due to villages, fields and plots and n, k and N the number of villages, fields and plots respectively. The estimates of true variances obtained from the present data are

$$\text{Due to villages } (V) = \frac{1595 - 1150}{4} = 111 \text{ per village.}$$

$$\text{Due to fields } (F) = \frac{1150 - 154}{2} = 498 \text{ per field.}$$

$$\text{Due to plots } (P) = = 154 \text{ per plot.}$$

By substituting these values in the formula above, the amount of sampling and its optimum distribution for securing a given degree of precision for the mean yield can be determined. To illustrate this on the basis of the present results, the average yield will have a standard error of 5 per cent., i.e., this average will be subject to a maximum chance fluctuation of 10 per cent. on either side of the estimated value, if the following sampling is adopted.

Number of villages (n) required to give 5 per cent. s.e. of mean

No. of fields per village (k)	No. of plots per field (N)	
	1	2
1	194	175
2	111	101
4	70	65
8	49	47
10	45	43

The relative importance of the number of plots per field and of the number of fields per village in determining the number of villages is clearly brought out in this table. The number of villages shown above refers to the whole region whose mean yield is required to be determined with a standard error of 5 per cent. It may be a single district or all cotton-growing districts in the province taken together. In the latter case, the accuracy of mean yields in the individual districts will be naturally much less. Subdivision of the area sampled into smaller units such as *tahsils* of a district is important both for administrative convenience and for securing increased accuracy of the final mean since errors are usually of different magnitudes in the different subdivisions.

The subdivision of plots into $^1/_{20}$ acre sections was intended to provide information on the relative merits of plots of different sizes. Three plot sizes $^1/_{20}$, $^1/_{10}$ and $^3/_{20}$ acre could be compared as in a uniformity trial and the coefficients of variation were found to be 24·1, 20·0 and 18·1 respectively. While there is thus a gradual reduction in error as plot size is increased its magnitude is not appreciable, and when other factors which contribute to the ultimate error of the mean yield are taken into account, it does not appear that the choice of a particular plot size in preference to another is likely to be of any importance in increasing the accuracy of mean yield. Questions of practical convenience will then determine the plot size to be adopted and $^1/_{10}$ acre plots which are at present in use appear quite satisfactory. By replacing $^3/_{10}$ acre plots used in calculating the number of villages required to give a 5 per cent. standard error of the average yield shown in the table above by $^1/_{10}$ acre plots, no material change was observed in the figures.

The cost of field work may be divided into two parts, one being the cost of harvesting which will depend on the total area harvested, i.e., on the total number of plots, and the other would include the cost of travelling and supervision. To save travelling from village to village it is clearly advantageous to reduce the number of villages and increase the number of fields per village. The question of minimum or optimum cost can be examined theoretically; such examination, however, is of little value unless the data on which it is based refer to the routine adopted in practice and not derived from a special inquiry. But with the large-scale adoption of this method for estimating yield relation between cost and statistical accuracy must receive increasing attention with the aim of minimising costs required to attain a prescribed degree of accuracy in the estimates.

The present survey was designed to fulfil the twofold objective of giving an unbiased estimate of the average yield of cotton in Akola District in the year 1942–43 and providing information essential for increasing the statistical efficiency of future surveys. The average yield per acre for the whole district was estimated from the survey at 136 lbs. of seed cotton and this had a standard error of 6·3 per cent. Taking into account the acreage under cotton, the estimated total production of cotton in the district came to 72,652 bales (1 bale = 392 lbs. of lint). It is important to note that the official estimate was over 41 per cent. higher than this figure and well outside the range of chance fluctuation of the experimental estimate. There can be little doubt that the former was a serious over-estimate of the production. On the other hand, it is interesting to record that the cultivators whose fields were sampled in the survey under-estimated their yield by 26 per cent.! With the help of the technical information now available, it is possible to raise the accuracy of the yield estimates, at the same time simplifying the sampling procedure. For instance, without any alteration in the number of villages or the total area harvested, we may introduce the modification that instead of having two plots in each field and two fields per village only one plot needed be located in each field and the number of fields per village increased to four. This is expected to reduce the standard error considerably. A further simplification would result from adopting a uniform plot size of $^1/_{10}$ acre and not subdividing it into sections for harvesting. The yield survey for Akola in 1943–44 was planned on these lines and a more accurate estimate of yield is anticipated without any increase in cost. For verification of the technical results, the survey was also repeated with the previous design in another district.

Forecasting of yield from the standing crop before it is harvested is of considerable importance to the trade and such forecasts based on the inspection of the crop are issued officially. The present survey provides some useful information on the accuracy of forecasts and the means of improving them. The forecast estimates of yield of the fields selected for the survey were made by the inspector in charge of the survey who was accustomed to making such estimates by eye judgment. He over-estimated average yield by 31 per cent.; but apart from this bias his estimates showed a fairly high correlation ($r = \cdot 8$) with actual yields. Corrected for bias, these forecasts would thus provide tolerable estimates of probable yield; but it cannot be assumed that either the magnitude or the direction of bias would remain constant in future seasons or in other districts. Experience elsewhere indicates that the bias changes in an unpredictable manner and it consequently appears impossible to prescribe a correction in advance. More reliable forecasts of yield should result from the use of objective methods such as quantitative observations on the yield constituents of the standing crop. This is particularly feasible for cotton where it is easy to count the number of plants in unit area, the number of mature bolls per plant and, when picking commences, the weight of seed cotton per boll. These observations were made in the present survey but it is not intended to discuss them here beyond mentioning that they did not, contrary to expectation, show a closer association with actual yield than eye inspection and frequently the latter proved superior. The

most probable explanation is provided by the fact that the observers were instructed to count those bolls which in their judgment would open during the harvesting season and contribute to yield; but this led to considerable variation in practice, some observers including in their count quite small bolls, others excluding considerably developed ones. More precise instructions are obviously needed on the type of bolls to be counted. The investigation is being continued.

This brief account of the cotton survey is presented to illustrate the application of the random sampling method to commercial crops as the most reliable means of estimating their yield. It is satisfactory to note that rapid progress is being made in the adoption of this method and sufficient data will soon be available for a more detailed discussion of its various aspects. Besides the extension of the cotton survey to two districts in Central Provinces in the past season, an investigation on similar lines was projected in two districts, one in the Central Provinces and the other in the Punjab, for estimating the yield of wheat. Two large-scale surveys embracing the whole provincial area under wheat were also carried out in the Punjab and the United Provinces last year. Immediate expansion of such yield surveys on a still wider scale can be recommended without hesitation; because the design described above has the advantage that besides giving unbiased estimate of yield for the area surveyed, it also provides data which form the basis for introducing such modifications in the plan of future surveys as are calculated to improve their efficiency. This improvement can go on steadily without in any way affecting the value of previous results. To achieve this end, it is most important, however, that the procedure adopted and the statistical results obtained should be under continuous review by a competent statistician charged with this work and not merely called in to give advice when difficulties arise. At present a number of crop cutting experiments are carried out by the staff of the revenue and agricultural departments and this personnel may be organised and utilized for field work under the new plan.

Not only for estimating yield, but for a variety of other investigations such as the effect of meteorological factors on crop, the spread of diseases and pests, spread of improved varieties of seed and other agricultural improvements, social and economic inquiries among the rural population, random sampling surveys on the pattern described here provide the most satisfactory means. A beginning in this direction is urgently necessary because past surveys of this kind have been frequently and justifiably criticized on the question of their respective character and the accuracy of their results.

The present survey was financed by the Indian Central Cotton Committee.

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PENICILLIN—NEW WAY OF MANUFACTURING DRUG

VARIOUS reports on home-made penicillin have appeared in the medical Press, but it has been pointed out that there are dangers in the uncontrolled use of this remarkable remedy, writes *The Times* medicinal correspondent.

He adds: A new account of an easy way to make penicillin, appearing in the current issue of the *British Medical Journal*, however, gets over the difficulties in that the produce described has been prepared and tested in a bacteriological laboratory. The author, who works at a London County Council hospital, records that a strain of penicillin, the parent substance used, was supplied by Professor Fleming, discoverer of the drug.

A mould is grown in a special solution and the filtrate obtained is carefully tested and assayed and then used without further manipulation usually as a form of local application. The whole method has the merit of simplicity and can be carried out in any bacteriological laboratory with well-trained staff. Some 24 patients have been treated by local application and in 19 cases the results have been wholly satisfactory.

It is thought that this product can be used for local disease until more refined products are made more generally available.—London, by cable.

OBITUARY

Dr. J. McKEEN CATTELL

WE deeply regret to record the death of Dr. McKeen Cattell, Editor of *Science* for nearly half a century, on the 20th January 1944, at the age of eighty-four. Formerly he was the Professor of Psychology at Columbia University.

In 1935 he was invited to accept the corresponding Editorship of *Current Science*. In accepting the invitation he wrote, "I greatly appreciate the honour of being invited to act as an associate editor of *Current Science* which is doing so much to advance the appreciation of Science in India. It gives me pleasure to accept and I shall do what I can to be of assistance in your work".

In the death of Dr. Cattell scientific journalism has lost one of its distinguished editors and *Current Science*, a valued and friendly supporter.

LETTERS TO THE EDITOR

A NOTE ON THE GENERALIZED VARIANCE OF MULTIVARIATE POPULATIONS

IN the case of multivariate populations the generalized variance for all practical purposes takes the place of the variance of single variate populations. This is obvious when we consider Fisher's t^2 and Hotelling's T^2. The present note gives the relationship between the generalized variance and the residual variances (on the basis of the size of the sample and not on the degrees of freedom) of the regression equations between the various variables.

The determinant

$$\begin{vmatrix} a_{11} a_{12} \cdots \cdots \cdots a_{1n} \\ a_{21} a_{22} \cdots \cdots \cdots a_{2n} \\ \cdots\cdots\cdots\cdots \\ \cdots\cdots\cdots\cdots \\ a_{n1} a_{n2} \cdots \cdots \cdots a_{nn} \end{vmatrix}$$

where $a_{ij} = \frac{1}{N} \Sigma (x_{ir} - \bar{x}_i)\ (x_{jr} - \bar{x}_j)$, is called the generalized variance of a multivariate sample of size N and of n variables.

It can be shown that the above determinant is equal to

$$s_1 \, s_{2\cdot1} \, s_{3\cdot21} \cdots \cdots \cdots s_{n\cdot12\cdots n-1},$$

where $s_{r\cdot12\cdots r-1}$ is Yule and Kendall's* notation for the residual variance of x_r expressed as a linear function of $x_1, \ldots\ldots\ldots x_{r-1}$.

The importance of this result lies in the fact that it will lead to the solution of various distribution problems connected with multivariate population without resorting to hypergeometry.

Imperial Agricultural Research Institute, New Delhi, *April* 19, 1944. P. V. KRISHNA IYER.

* Yule, G., Udny and Kendall, M. G., *An Introduction to the Theory of Statistics*, Griffin & Co., Ltd., London, 1940.

THE PRINCIPAL MAGNETIC SUSCEPTIBILITIES OF METAL CRYSTALS

MOST of the work on the determination of the principal magnetic susceptibilities of metal crystals has been carried out by preparing single crystals in the form of long rods.[1] The crystal is usually mounted with the long axis perpendicular to the magnetic lines of force of a magnetic field. The Gouy force on the specimen is studied at different orientations, when it is rotated through 360° about its long axis. From these results it is possible to calculate the principal magnetic susceptibilities, provided we know also *either* the angle ϕ between the principal crystalline axis and the long axis *or* the magnetic susceptibility of the polycrystalline specimen. The susceptibilities obtained by the Gouy method are volume susceptibilities. To determine the mass values, the density of the material has to be determined. It is well

known that the actual determination of the density value causes considerable error in the final values of the principal mass susceptibilities.

Shoenberg and Uddin[2] made small beads of bismuth crystals, fixed the trigonal axis by etching and determined the principal mass susceptibilities by the Sucksmith ring balance.

The very elegant torsional method developed by Krishnan[3] was applied by John[4] to the study of the temperature variation of the magnetic anisotropy of bismuth crystal. Further study of metal crystals by Krishnan's method appears to be of great value since the principal mass susceptibilities could be directly and accurately determined. If $\chi||$ and $\chi\perp$ are the mass susceptibilities parallel and perpendicular to the crystalline axis, Krishnan's method enables us to determine their difference $\chi||-\chi\perp$ directly. This difference is studied at different field strengths. Curie's method may then be employed to determine the mean susceptibility χ_{mean}, also at different field strengths. Since $\chi_{mean} = {}^1/_3\ (\chi|| + 2\chi\perp)$, it is easy to calculate $\chi||$ and $\chi\perp$ at different field strengths.

If the specimens contain traces of ferro-magnetic impurities, the principal mass susceptibilities may be determined, as usual, by extrapolating the χ, 1/H graphs.

Test experiments have been carried out with crystals of bismuth, zinc, cadmium and tellurium. The first three crystals have prominent cleavage in the basal plane. Small pieces from single crystal rods could be easily obtained. In the case of tellurium, the author and Govindarajan[5] had prepared tellurium crystals in the form of long rods, for magnetic measurements. One of these crystals, for which ϕ was 30°, was cut at the proper angle and the end faces of the small rods were etched. Bismuth and tellurium showed no ferromagnetic impurities while zinc and cadmium had minute traces. Very fine quartz fibres were used to suspend the crystals in the uniform magnetic field between the pole-pieces of a Pye electromagnet.

The results obtained are given below.

Crystal	Investigators	$\chi_{II} \times 10^6$	$\chi_{\perp} \times 10^6$
Bismuth	Focke[6]	− 1·053	− 1·482
	John[4]	− 1·05	− 1·45
	Author	− 1·058	− 1·495
Zinc	McLennan, Ruedy and Cohen[7]	− 0·190	− 0·145
	Rao[8]	− 0·202	− 0·149
	Author	− 0·206	− 0·147
Cadmium	McLennan, Ruedy and Cohen[7]	− 0·261	− 0·160
	Rao and Sriraman[9]	− 0·223	− 0·163
	Author	− 0·234	− 0·159
Tellurium	Rao and Govindarajan[5]	− 0·329	− 0·296
	Author	− 0·342	− 0·289

A careful estimate of the errors involved brings the margin of error in the author's values to one per cent.

It is found that the results obtained by Krishnan's method agree satisfactorily with those by other methods. In the case of tellurium, the present investigation confirms the small anisotropy previously recorded by Rao and Govindarajan.[5] It is proposed to apply this method to further studies of crystal magnetism of metals, particularly from the point of view of the influence of impurity traces on magnetic anisotropy.

I thank Mr. H. S. Venkataramiah for much valuable help.

Department of Physics,
Central College,
Bangalore, S. RAMACHANDRA RAO.
April 16, 1944.

1. For details see Bates, *Modern Magnetism*, p. 144. 2. *Proc. Roy. Soc.*, 1936, **A 156**, 687. 3. *Phil. Trans. Roy. Soc.*, 1935, **234**, 265. 4. *Z. Krist.*, 1939, **101**, 337. 5. *Proc. Ind Acad. Sc.*, 1939, **10**, 235. 6. *Phy. Rev.*, 1930, **36**, 319. 7. *Proc. Roy. Soc.*, 1928, **121**, 9. 8. *Proc. Ind. Acad. Sc.*, 1936, **4**, 186. 9. *Proc. Roy. Soc.*, 1938, **A 166**, 325.

VAN DER WAALS' COHESION CONSTANT

IT has been known for a long time that there is a close relation between surface tension and Van der Waals' constants 'a' and 'b'. Van der Waals himself on certain assumptions deduced that

$$\sigma_0 = A_1\theta_c V_c^{-2/3} = Aa/b^{5/3}, \qquad (1)$$

where A_1 and A are constants, θ_c and V_c the critical temperature and critical volume respectively, and σ_0 is defined by the fundamental (empirical) relation

$$\sigma = \sigma_0 (1 - \theta)^n, \qquad (2)$$

θ being the reduced temperature and n a constant which is nearly equal to 1·2 for all unassociated liquids. Ferguson[1] in a recent paper has found that the experimental values of σ_0, θ_c and V_c are in better accord with the relation

$$\sigma_0 = 3{\cdot}12\ \theta_c V_c^{-0{\cdot}55}. \qquad (3)$$

Recently we have been investigating the properties of liquids on the 'hole' model originally given by Fürth[2] and his collaborators in a series of papers. In this connection we were led to a simple *theoretical* relation between Van der Waals' cohesion constant and the surface tension. In a paper to be published shortly we have constructed and solved the Schrödinger equation for a 'hole' in a liquid and have determined the eigenvalues for its energy. The energy values E_n are given approximately by the expression

$$E_n = 3{\cdot}61 \left(n + \frac{7}{10}\right)^{4/7} \frac{\sigma^{5/7} h^{4/7}}{\rho^{3/7}}, \qquad (4)$$

where h is the Plank constant and ρ the density of the liquid. The theory gives for the intrinsic pressure for Van der Waals' cohesion constant the expressions

$$p_0 = 2{\cdot}4\,\sigma\left(\frac{\sigma\rho}{h^4}\right)^{1/7} \qquad (5)$$

$$a = 2{\cdot}4\,V^2\sigma\left(\frac{\sigma\rho}{h^4}\right)^{1/7}, \qquad (6)$$

where V is the molecular volume of the liquid. A comparison between the theoretical and experimental values shows that the variation of 'a' with σ and ρ is as required by the theory but the constant of proportionality is nearly 0·6 times its theoretical value.

University of Delhi, F. C. AULUCK.
April 1944. R. N. RAI.

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CATALYTIC FORMATION OF METHANE FROM CARBON MONOXIDE AND HYDROGEN—A STUDY OF NICKEL AND NICKEL ALUMINA CATALYSTS PREPARED FROM THE HYDROXIDE USING POTASSIUM, SODIUM AND AMMONIUM HYDROXIDES AS PRECIPITANTS

IN a humid mixture of carbon monoxide and hydrogen 1: 1 (roughly) by volume the following reactions took place in presence of nickel catalysts.

1. $2CO + 2H_2 = CH_2 + CO_2$.
2. $CO + H_2O = CO_2 + H_2$.

The influence of potassium, sodium and ammonium hydroxides used as precipitants for preparing the nickel catalysts on the relative rate of the above reactions if any was small and will be evident from the experiment No. 1_K 1_{Na}, and 1_{Am}, in Table I.

The effect of alumina as a promoter for favouring the reaction 1 was prominent and this is borne out by the comparative study of Table I with Table II where II_K, II_{Na}, and II_{Am} are alumina promoted catalysts. Moreover the promoter action of alumina depends on its concentration also. This will be clear if we compare Table II where the catalysts contain alumina to the extent of ·085 per cent. with Table III wherein the catalysts III_K, III_{Na}, and III_{Am}, the alumina content is 0·160 per cent. We find that concentration of the promoter for highest activity should be a figure which is lower than 0·160 per cent.

On the other hand Table IV will show that on addition of traces of potassium carbonate to the alumina promoted catalysts (II_K and II_{Am}) reaction 2 is preferentially accelerated.

Department of Chemistry,
Dacca University, K. M. CHAKRAVARTY.
January 11, 1944. J. M. SARKER.

Expt. No.*	Wt. of catalyst in gm.	Vol. of catalyst in reacn. tube in c.c.	% composition of reactants: % CO	% H_2	% H_2O	Space vel. N.T.P. per hr.	No. of litres of gas passing	Reaction temp.	% composition of the resultants: % CO_2	% CH_4	% H_2	% CO	% H_2O	CO_2–CH_4	$\frac{CH_4}{CO_2-CH_4}$ ‡
TABLE I															
K	·5028	3·77	30·31	38·77	31·27	206	25	387·2	21·32	16·01	26·72	2·68	34·27	6·31	2·39
Na	·5018	,,	29·70	39·51	30·87	205	,,	,,	20·85	15·17	26·82	2·58	34·58	5·68	2·67
Am	·4988	,,	30·47	38·51	31·02	205	,,	,,	21·66	15·46	25·70	2·78	34·41	6·20	2·48
TABLE II															
II_K	·5000	3·77	30·32	37·90	31·78	207	25	340	21·08	18·27	18·70	1·37	39·88	3·53	5·17
II_{Na}	·5000	,,	31·00	36·60	32·40	208	,,	341	22·74	19·20	15·69	0·98	41·39	3·52	5·51
II_{Am}	·4980	,,	29·96	38·28	31·76	208	,,	340·1	21·42	18·20	19·00	1·20	40·06	3·22	5·65
TABLE III															
III_K	·5008	3·77	30·10	37·65	32·25	207	25	339·1	21·74	17·52	20·01	1·40	39·33	4·22	4·15
III_{Na}	·5000	,,	30·68	37·17	33·29	207	,,	339·3	21·84	17·48	19·63	1·33	39·22	4·36	4·00
III_{Am}	·5004	,,	30·65	39·02	30·33	207	,,	339·5	22·37	17·99	21·39	1·31	39·91	4·38	4·09
TABLE IV															
$II_K + K_2CO_3$	·5007	3·77	30·49	38·83	30·68	207	25	340·2	22·67	18·76	19·77	0·49	38·26	3·91	4·75
$II_{Am} + K_2CO_3$	·5000	,,	30·45	38·43	31·02	207	,,	340·5	22·69	18·69	19·45	0·56	38·71	3·90	4·71

* Suffix K, Na and Am after I, II, and III indicates that catalysts have been prepared under identical conditions using respectively KOH, NaOH and NH_4OH as precipitants.

‡ CH_4/CO_2–CH_4 indicates the ratio of the rate of reaction (1) to that of reaction (2).

A METHOD FOR THE ASSAY OF INDIVIDUAL ERGOT SCLEROTIUM

In previous communications on the subject,[1,2] one of the authors (B.M.) had stressed the need of ergot cultivation in India and recorded observations on the quality of Indian-grown ergot. Since then, satisfactory progress has been achieved in the production of medicinal ergot and further attempts are under way towards improving the strain of the fungus to yield higher alkaloidal contents.

In such efforts, as well as in the study of the medicinal value of various strains of ergot reported growing in Indian grasses,[3] one of the major handicaps has been the absence of a suitable micro-method for determining the alkaloidal contents of a few small ergot sclerotia. The B.P. method of colorimetric assay requires 12 gm. of ergot powder, a quantity hardly ever available for such experimental studies.

Bekesy[4] has described a method of analysing the alkaloidal content of individual ergot sclerotia but this reference could not be secured in India. An attempt was, therefore, made to devise a modified method based on the B.P. procedure using as small a quantity of ergot powder as is possible consistent with accuracy of determination. The following method appears to work well in our hands, though the results are only roughly quantitative. Fairbairn[5] has employed more or less a similar method for qualitative assay of ergot.

> "Shake vigorously 0·1 gm. (0·05 gm. is also sufficient) of powdered ergot (usually obtained from 1 or 2 big ergot sclerotium) with 5 c.c. of a 5 per cent. sol. of Na_2CO_3 for a few seconds. Add 10 c.c. $CHCl_3$ and shake; filter through a plug of cotton wool to break the emulsion formed. Wash the clear $CHCl_3$ sol. with a little H_2O. Transfer 6 c.c. of this $CHCl_3$ to a test tube and add 3 c.c. of the following reagent (p-dimethylaminobenzaldehyde—0·1 gm.; H_2SO_4 35 per cent. v/v)—100·0 mils.; Sol. of $FeCl_3$ (5 per cent.)—1·5 mils.
>
> The colour developed can be matched against a known strength of ergotoxine ethanesulphonate using the same reagent. The accuracy of the measurement is increased by using a Pulfrich photometer, in the same way as in the case of estimation of B.P. ergot."

Using this method, several readings have been taken with individual sclerotium from one batch of Indian ergot received from Coimbatore through the courtesy of the Government Mycologist, Madras. Figures (duplicate) were found to vary within wide limits, *e.g.*, 0·183 mg., 0·143 mg., 0·160 mg., 0·130 mg., etc., indicating that all sclerotia did not develop the active alkaloids to the same extent. The average figure for the batch came up to about 0·165 mg. by this method. By following the B.P. method, a figure of 0·145 mg. was obtained. This shows that the method of assay with small quantities of ergot is only a roughly quantitative method but nonetheless a dependable and workable one.

So far the alkaloidal content of ergots obtained from two grasses (*Chrosologon zeylanicus* and *Oplisimems compositus*) growing in South Indian hills (forwarded by the Government Mycologist, Madras) have been tested by the above method. The first gave a faint trace of ergot alkaloids, while the second gave negative results. Padwick and Agmatullah[6] have described two ergots found in the Simla Hills. One of them is on *Oplisimems compositus* but is reported to be different from *C. purpurea* and is named by them as *C. viridis*. This may be one explanation of the low alkaloidal content of ergots growing on grass hosts, as *C. purpurea* has long been known as the fungus which develops the medicinally important alkaloids in the ovary of the rye.

Biochemical Standardisation Laboratory, Govt. of India, Calcutta, *May* 5, 1944.

B. Mukerji.
N. K. De.

1. Mukerji and Bose, *Sci. and Cult.*, **1942**, **8**, 267. 2. — and De, *Curr. Sci.*, **1943**, **12**, 87. 3. Pushkar Nath and Padwick, *Ibid.*, **1941**, **10**, 488. 4. Bekesy, *Biochem. Zeitung.*, **1939**, **302**, 187. 5. Fairbairn, *Pharm. Jour.*, March 13, **1943**. 6. Padwick and Agmatullah, *Curr. Sci.*, **1943**, **12**, 257.

EXTRACTUM PITUITARII LIQUIDUM FROM INDIAN CATTLE GLANDS

Considerable interests are now being focussed on the production of medicaments from glands available in India. One of the most essential drugs in this group is the posterior pituitary extract. It is an aqueous extract of the posterior lobes of pituitary bodies of oxen or other mammals and contains 10 International Units per c.c. According to B.P., Addendum 1936, the product should retain its potency for at least eighteen months after the date of manufacture. Recently Dey, Krishnan and Giriraj[1] have recorded the weight of pituitary glands as obtained in Madras, and have also prepared[2] dried posterior pituitary powder from the whole glands. In this laboratory the above powder is being systematically prepared for the last decade from cattle glands as collected from the Calcutta Corporation Slaughter House. In the table the weights of the whole pituitaries, fresh and desiccated posterior lobes, are being recorded along with those as found from American animals. The average potency of desiccated posterior pituitary powder as imported from abroad, has been found in our hands to vary from 82-90 per cent. in comparison with the International standard powder. The powder that is prepared in our own laboratory exerts on average a potency of 85 per cent. This on extraction with 0·25 per cent. acetic acid and on subsequent treatment affords the extractum Pituitarii

Type	Whole Pituitary		Weight of Posterior portion gm.	Desiccated powder	
	Number	Weight gm.		Weight gm.	Potency %
Foreign	100	225	25	4	82-90
Local	100	150	20	2·8	85

Liquidum. Each c.c. of this extract contains 10 International Units and maintains its potency for about three years.

From the above table it would be evident that though the potency of the dry posterior pituitary powder as obtained from the local glands is not at variance with that of the imported powder, the yield of the desiccated powder itself is about 30 per cent. less. Every precaution is taken in collecting, trimming, and drying the glands. In this connection references may be made to a previous observation by Basu, Bose and Das Gupta[3] on the lower yield of cholates from Indian ox bile. The question arises whether the active principles of the various glandular products from Indian animals can be further increased and/or improved by altering the breed and directing more attention to the nutrition as well as mode of slaughter of our domestic animals.

It has been noted by Dey *et al.*[2] that the annual requirements in India of posterior pituitary extracts correspond to about 2,500 gms. of the dried posterior powder. No mention has, however, been made of its standard and quality. Taking this to be of International standard the theoretical amount of units that might be obtained from the above powder, would be 5 million units.

Bengal Immunity Research Laboratory, Calcutta.
March 22, 1944.

U. P. Basu.
A. N. Bose.
S. C. Guha.

1. *Curr. Sci.*, 1944 **13**, 35. 2. *Jour. Sci. Ind. Research*, 1944, **2**, 87. 3. *Indian Med. Gazette*, 1940, **75**, 215.

A NEW QUALITY WHEAT FOR BOMBAY

The annual wheat acreage in Bombay Province covers an area of nearly 16 lacs of acres. The bulk of the area is under dry wheat and is concentrated in the north-central Deccan, north Gujarat and eastern Karnatak. Almost all of the main tracts have now suitable improved strains of dry wheats. The irrigated wheat area in the Province, however, varies from 1,50,000 to 2,00,000 acres annually, and although the area is comparatively small, it is scattered throughout the Province. The varieties of wheat under irrigation are Khapli (*T. dioccocum*), Baxi (*T. durum*) and Mondhya (*T. vulgare*), the latter being once the most extensively grown wheat. During the last twenty to twenty-five years, however, Pusa wheats have replaced the local irrigated wheats, especially the Mondhya variety. Of the various Pusa wheats, Pusa-4 (now I.P. 4) has spread very extensively, due mainly to its shorter period of maturity than local varieties, which helps it usually to escape steam-rust of wheat as well as saves the farmer an irrigation or two.

Although Pusa-4 has spread widely it has certain drawbacks. It shatters its grain rather easily if not harvested just in time. It does not tiller well and due to fewer leaves per plant the straw is coarse. Farmers, therefore, complain of its poor quality of *bhusa*. Moreover, Pusa-4 is an awnless wheat which affords it little protection against the attack by birds.

In the year 1932-33 Pusa-4 was crossed with a synthetic durum, Bansipli-809, with a view to combine the good characters of the two species. Bansipli-809 is itself a derivative from the cross of a synthetic Khapli, K. K. 568, and an improved durum strain, Motia (Bansi-168).

Niphad-4 Pusa-4

Bansipli-809 has black awns like Kala-Khapli-568, but unlike either Kala-Khapli or Motia varieties, it is an earlier maturing type. From

Table I

Milling and baking quality behaviour of Niphad-4 and its parents, Pusa-4 and Bansipli-809

Name of wheat	100 grain wt. gm.	Mottled grain %	Protein %	Feeds %	Straight run flour %	Loaf volume c.c.	Loaf type	Grain No.	Quality score %
N-4 (1942)	4·67	1·8	13·52	20·7	75·8	680	FH	6	85·0
N-4 (1943)	5·01	1·2	13·30	22·0	75·2	620	F	4	78·0
P-4 (1943)	4·38	7·4	13·40	23·6	73·0	510	FJ	3-4	65·0
Bansipli-809 (1943) ..	4·90	0·0	14·10	24·0	71·8	345	JK	3 Under-developed	36·5

the cross of B-809 and Pusa-4 pure breeding, synthetic vulgare-like cultures were obtained in 1936-37. Comparative trials of these cultures with Pusa-4 for four years, from 1937-38 to 1941-42, at the Cereal Breeding Station, Niphad, showed that the culture 5-1-38-5 was the best. It was released for district trials in 1942-43 under the name Niphad-4. District trials in the Nasik and Ahmednagar districts of the Deccan and in the Kaira district of Gujarat showed that Niphad-4 was better in various agronomic characters than Pusa-4 and Pusa-52 respectively. At the Cereal Breeding Station, Niphad, as well as in the districts it has usually given 7 to 8 per cent. more yield of grain than Pusa-4. Niphad-4 is more leafy and tillers more heavily than Pusa wheat and thus its *bhusa* is better than the latter.

Niphad-4 requires about 120 days from sowing to harvest, the life-period being more or less the same as that of Pusa-4. The awns of Niphad-4 are black at the base and glumes are white and hairy. These two characters would help to rouge fields of Niphad-4 as no other irrigated wheat in Bombay, except Baxi, possesses this character-combination. Baxi, however, is a durum wheat, and the shape of its ear and length of awns are quite distinct from those of Niphad-4. The full-awned condition of Niphad-4 affords it better protection from the attack of birds.

The grains of Niphad-4 are like those of a durum wheat; they are larger, 100 grains weighing nearly 5 grams as against 4·5 grams of Pusa-4. Unlike the Pusa wheat Niphad-4 does not shatter grains.

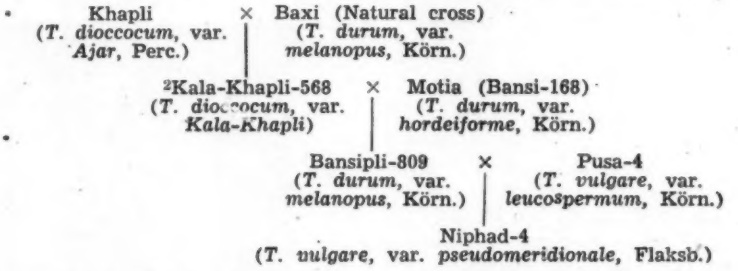
Like Pusa-4 the new wheat is also susceptible to all the known races of stem-rust in India and to remedy this defect it has been crossed with certain immune Kenya wheats.

In the year 1942 and again in 1943 samples of Niphad-4 were sent to Rao Bahadur Ramdhansingh, Cerealist, Department of Agriculture, Punjab, to determine its milling and baking qualities. With the second lot of Niphad-4, samples of seed of its parents—Pusa-4 and Bansipli-809—were also supplied. Comparative milling and baking data of Niphad-4 and its parents were kindly supplied to us by the Cerealist. The more important information is presented in the following table.

It will be seen from the above figures that Niphad-4 surpasses Pusa-4 in almost all the milling and baking attributes in both the years. It will be noted that Niphad-4 developes fewer mottled grains and its flour-yield is 3 per cent. more than that of Pusa wheat. The loaf-volume of the new wheat is much higher than that of Pusa-4 and in quality-score it considerably, outpoints the Pusa wheat. Ramdhan Singh[1] observes, "Niphad-4 showed an exceptionally high baking quality. In fact it turned out to be one of the very best wheats handled by us so far. By yielding a shapely loaf of bread with an even crust of almost uniform break and shred, approaching Manitoba wheat in this respect, crumb of white colour, soft, resilient texture, silky to touch, an even 'grain' with rather elongated pores having thin cell walls, it scored as high as 79·7 baking marks. It also showed the highest oven-spring of 2·0 cm."

Niphad-4 also yielded best *chapatees*. Its *chapatees* were sweetish in test, softest and most pliable and were highest in fresh weight. They were, however, tough and greyish in colour.

The pedigree of Niphad-4 is as follows:—



The new wheat is now being multiplied for spread in the irrigated tracts of the Bombay Province.

Cereal Breeding Station,
Kundewadi, Niphad,
(H.Q. College of Agriculture,
Poona 5), B. S. KADAM.
March 14, 1944.

1. Ramdhan Singh, "Progress Report of the Scheme for Wheat Milling and Baking Tests for the Year ending June, 1943", I.C.A.R. and Department of Agriculture, Punjab, 1943. 2. Kadam, B. S., "Genetics of the Bansi Wheat of the Bombay Deccan and a Synthetic Kapli, Part I," *Proc. Indian Academy of Sciences*, 1936, **4**, No. 5, 357-69.

VERNALIZATION OF JUTE

THE effect of pre-sowing treatment on drought-resistance and yield in paddy by Parija[1] and on anthesis in wheat by Chinoy[2] have been reported. In the present communication the effect of pre-sowing treatment (alternate moistening and drying) and post-sowing light treatment on drought-resistance and earliness of flowering respectively on two species of jute—*Corchorus capsularis* (D. 154) and *C. olitorius* (Chinsura green) are reported. The seeds were allowed to swell in water for six hours and then gradually dried in dark at a tempe-

rature of 30° C. This alternate moistening and drying was continued and repeated for ten days. Every day the seeds were allowed to absorb water for three hours and then dried. This sort of prolonged treatment was made possible by means of the vernalization apparatus described before.[3] The treated seeds were sown in tubs as well as in replicated plots against control seeds (untreated but

TABLE I

Period of drought in days	% Moisture of the soil	% of seddlings wilted in			
		C. capsularis		*C. olitorius*	
		Treated	Untreated	Treated	Untreated
9	From 30% 6·8%	15·2%	45·0%	28·2%	63·0%
12	5·3%	20·4%	67·8%	45·3%	85·1%
Percentage recovery after 5 hrs. on watering		89·6%	42·3%	52·6%	20·2%

TABLE II

Photoperiods*	Long days (20 hours)	Short days (8 hours)	Control (10–12 in.)
C. capsularis	120 days	69 days	116 days
C. olitorius	128 „	64 „	121 „
Difference from control in—			
C. capsularis	4 days (late)	47 days (early)	..
C. olitorius	7 „ „	57 „ „	..

soaked overnight in water). The drought-resistance capacity of the seedlings were tested on the basis of wilting of the leaves and growing tips.

There was no difference in percentage germination as a result of treatment. The treated seeds sprouted earlier and the seedlings showed an increased growth in height than the untreated seedlings of the same age. The seedlings were allowed to grow under normal conditions for a week and then were subjected to drought conditions. The moisture content of the soil in the tubs were brought to the same level of 30 per cent. of the soil. Then no water was given for a period of twelve days. The percentage of wilting of the seedlings in different treatments are given in Table I.

It was thus found that under the same conditions of drought, a larger percentage of untreated seedlings showed wilting than the treated ones and on watering the tubs again the percentage of recovery was also greater in the treated seedlings. The response to treatment also varied in the two species; *C. capsularis* showing greater resistance to drought than *C. olitarius*.

A similar method of pre-sowing treatment also brought about an earliness in flowering which was found to be on the average 6.0 days in plants grown under normal conditions. A significant earliness was, however, caused by regulating the post-sowing photoperiods as shown in Table II.

The post-sowing light treatment of short days was effective in bringing a significant earliness of flowering as observed by Sen Gupta and Sen,[4] but the long days were either not effective or showed a tendency towards retardation of flowering. The detailed results will be published elsewhere.

Bose Institute,
Calcutta, B. K. KAR.
February 14, 1944.

* The different light periods were given to the seedlings at the age of 35 days and continued for a period of 17 days. The rest of the life-cycle was passed under normal day and night conditions.

1. Parija, *Curr. Sci.*, 1943, 3, 89. 2. Chinoy, *Ibid.*, 1942, 10, 400. 3. Kar, *Trans. Bose Inst.*, 1942–43, p. 105. 4. Sen Gupta and Sen, *Proc. 31st Ind. Sci. Cong.*, 1944, p. 89.

NOTE ON LUMINESCENCE IN SOME ALLAHABAD EARTHWORMS

THE cœlomic fluid of each Rangoon species of *Eutyphœus*, and also that of the single species of *Lampito*, glows with a more or less brilliant luminescence, when ejected through the dorsal pores[1] into a dilute solution of ammonia (Gates, 1925).

The cœlomic fluid of three species of *Eutyphœus* present in Allahabad, *E. incommodus* (Beddard, 1901), *nicholsoni* (Beddard, 1901), *waltoni* (Michaelsen, 1907), also glows in the

ammonia solution. The Rangoon species of *Eutyphœus*, like *nicholsoni* and *waltoni*, are metandric, but *incommodus* is holandric. As luminescence has been found in both sections of the genus, in each species that has been tested, the photogenic ability may now perhaps be expected to characterize the whole genus.

Specimens of *Ramiella nainiana* Gates (in press) give off, in the ammonia solution, a sticky slime which also luminesces, the glow brighter than that of *Lampito mauritii* Kinberg (1867), but not as bright as that of the Allahabad species of *Eutyphœus*.

One other species of *Ramiella*, a rather small one (*cultrifera* Stephenson, 1931), is found in Allahabad. Worms of this species, however, have produced no luminescence in any of several trials. *Octohœtoides ferrari* (Michaelsen, 1907), like the Rangoon species of the same genus, also appears to have no photogenic ability.

Ewing College,
Allahabad, G. E. GATES.
May 2, 1944.

1. Gates, G. E., "Note on Luminescence in the Earthworms of Rangoon," *Recs. Indian Mus.*, 1925, **27**.

ON THE LARVAL CERIANTHARIA FROM THE MADRAS PLANKTON

Isodactylactis tardiva, *I. discors*, *I. præcox* (Senna[1]), *Anactinia pelagica* (Annandale,[2] Menon[3]), *Arachnactis indica* (Menon,[4] Panikkar[5]) and *Apiactis bengalensis* (Panikkar[6]) are the larval Ceriantharia known from the Bay of Bengal. Madras plankton is fairly rich in these larvæ and all the genera mentioned except *Isodactylactis* are represented. In addition to these genera, the genus *Isarachnactis*, so far recorded only from the Mediterranean Sea (Carlgren[7]) and the Arabian Sea (Panikkar[8]) is represented in the Madras plankton by a rare and unidentified species. Further, an extremely rare, small, tentacleless larval Ceriantharia, probably belonging to the genus *Anactinia*, occurs in the plankton collections along with *A. pelagica*. These pelagic larvæ appear in fair numbers generally during the colder months of the year.

The first larval Ceriantharia, *Arachnactis albida*, was discovered in 1846 by Sars[9] and the first adult, *Cerianthus membranaceus*, in 1784 by Spallanzani.[10] Since then, about fifty larval Ceriantharia and about an equal number of adults have been discovered. Surprisingly none of these larval forms have been correlated with the adult forms by the actual study of the metamorphosis and growth of the larvæ into their respective adults.

At the suggestion of Professor R. Gopala Aiyar such a correlation of the larval forms of Ceriantharia occurring on the Madras Coast with their adults was undertaken and has proved very successful. The larvæ obtained from the townet collections on being transferred to the Laboratory aquarium tanks begin metamorphosis in a couple of days, if a suitable substratum of sand or of sand and mud is given. Metamorphosis may be said to have commenced when the floating larvæ sink to the bottom and begin to burrow into the substratum which they do by means of the aboral end.

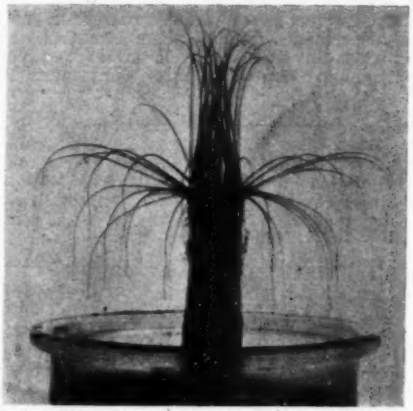


FIG. 1. Adult of *Apiactis bengalensis*, 348 days old with 65 marginal tentacles. × $^2/_3$.

With the growth of the larvæ, the colouration characteristic of the adults becomes more and more discernible. A regular change of clean sea water is essential. Raw flesh of *Emerita* and *Acetes* was given as routine food and the specimens flourished very well under these conditions.

There is considerable variation in the tubes of the different genera. *Apiactis* burrows into the sand and constructs a tube for life which

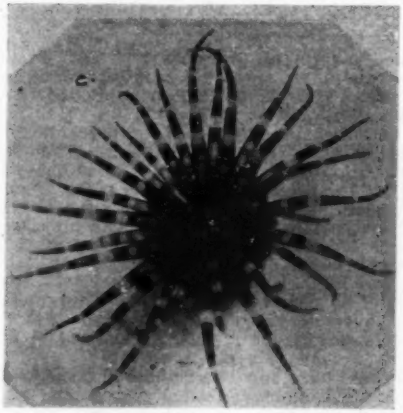


FIG. 2. Adult of *Isarachnactis* sp., 595 days old with 29 marginal tentacles. × $1^1/_2$

enlarges with the growth of the animal. Part of this tube projects above the level of the substratum. The white and jelly-like tube is composed entirely of nematocysts and mucus. No sand particles are used in the construction of the tube which is inseparably associated with the animal. The tube

of *Isarachnactis* is irregular, branched and meandering. The animal deserts the tube occasionally to construct another. The tube is composed mainly of sand particles held together by nematocysts and mucus. *Anactinia* is

FIG. 3. Adult of *Anactinia pelagica*, 186 days old with 34 marginal tentacles. × 3/4.

not a regular burrower but constructs round its body a thin, loose and transparent tube formed of nematocysts and mucus. This form has the peculiar habit of deserting its tube at frequent intervals.

All the larval Ceriantharia collected from the Madras plankton have been successfully reared into healthy adults. The photographs of some of the adults of the larvæ reared in the Laboratory and taken in the living condition are

FIG. 4. Adult of *Anactinia* sp., 68 days old with 26 marginal tentacles. × 1.

2a

reproduced here. The age given in each case is calculated from the commencement of the metamorphosis as indicated by the settling down of the larva.

The detailed morphological and taxonomical characters of the larvæ and their respective adults, together with the structural changes during metamorphosis will be given elsewhere.

Zoological Research Lab.,
University of Madras, R. VELAPPAN NAIR.
April 10, 1944.

1. Senna, A., Raccolte Planctoniche fatte dalla R. Nave 'Liguria', 1907, **1**, 3. 2. Annandale, N., *Rec. Ind., Mus., Calcutta*, 1909, 3. 3. Menon, K. R., *Ibid.*, 1914, 10. 4. Menon, K. S., *Ibid.*, 1921, 33. 5. Panikkar, N. K., unpublished. 6. —, *Zool. Anz.*, 1936, 115. 7. Carlgren, O., *Wiss. Erg. Deutsch. Tiefsee-Exp.*, 1924, **19**, 8. 8. Panikkar, N. K., *Curr. Sci.*, 1938, **7**, 6. 9. Sars, M., *Funa littoralis Norvegiæ*, 1846, 1. 10. Spallanzani, L., *Mem. Soc. Ital. di Verona*, 1784, 2.

PREVENTION OF DAMAGE TO STORED POTATOES BY THE POTATO TUBER MOTH*

THE potato tuber moth is a most destructive pest of stored potatoes in India and elsewhere: it may destroy cent per cent. of the potato seed stored in the hills from the spring crop for sowing in the plains in September-October. Research on finding an effective control has been in progress since 1907, but so far no satisfactory solution of the problem has been found. The urgent and great need for saving stored potatoes from destruction by this pest particularly during the war, makes it imperative to discover, without any further loss of time, preventive measures against it, well within means and reach of the cultivator. With this object in view I took up work on this pest last year and the resuts which I have obtained in the first year of my work are so striking and encouraging that I have thought it desirable to place them before the scientific public in India with the hope of receiving helpful criticism and stimulating further study of the problem. In these investigations the main consideration is to utilise articles which are commonly found in the localities in which potatoes are stored.

In the Punjab seed potatoes are generally stored during July—second week of September in the Kangra Valley. Therefore, trials with various covering articles were carried out in the Valley at Palampur (Punjab). 43 maunds and 8 seers of mature and sound potatoes were used in these experiments.

The total quantity of potatoes was divided into 56 small heaps, 32 of which contained 24 seers of potatoes each, while the remaining 24 heaps contained 40 seers each. 48 Heaps (24 of 24 seers each and 24 of 40 seers each) were placed in as many compartments in two wooden racks A and B respectively, while the remaining 8 heaps (each of 24 seers) were placed on a pacca floor. Each shelf in the racks was made of strips of wood nailed together and covered with bamboo matting. Potatoes stored in the racks and those on the

floor were kept in a room which was not insect-proof; each of the 24 seer heaps were 3 in. deep, while the 40 seer heaps were 5 in. deep. Out of each group of 8 heaps one was kept as control and the remaining seven were covered with a one-inch thick layer of dry chopped lantana, saw dust, "bhusa", dry local grass, dry soapnut leaves, sand and pine needles respectively, selection for each treatment being made by randomization. There were thus three replications on each rack and one on the floor. The heaps in the racks were covered on top while those on the floor were covered on the sides also. After covering the healthy potatoes with these articles, 8 maunds of tubers, heavily infested with the pest, were uniformly distributed in the room.

During storage, in addition to the potato tuber moth, potatoes are destroyed by a fungus disease which causes rotting. Therefore, for judging the efficacy of the various covering articles, loss due to the pest and to the fungus disease was taken into consideration and the results obtained are tabulated below:—

Table showing effect of covering potatoes in storage with different articles

Treatment	Average % of loss in Rack A due to		Average % of loss in Rack B due to		Average % of loss on pacca floor due to	
	Potato tuber moth†	Rotting	Potato tuber moth†	Rotting	Potato tuber moth†	Rotting
Control	50·6	6·1	56·1	4·2	73·1	4·4
Lantana	2·6	3·1	1·7	2·1	8·0	3·1
Saw dust	2·1	3·6	0·3	2·5	3·1	4·6
Bhusa	1·8	9·9	3·1	2·5	6·2	1·5
Grass	2·7	2·6	3·2	3·4	10·4	2·9
Soapnut leaves	4·7	2·9	2·5	2·1	10·6	5·4
Sand	5·3	5·7	2·4	3·1	—	4·8
Pine needles	4·1	3·5	7·3	3·5	29·1	6·2

It will be seen from the above table that the percentage of loss due to insect attack as well as rotting was higher when potatoes were stored on the floor than when they were stored on racks. Saw dust, lantana, local grass, and "bhusa" gave good results. These experiments are being continued.

Entomologist to
Government, Punjab,
Lyallpur, KHAN A. RAHMAN.
April 11, 1944.

* *Phthorimæa operculella* Zell. *Gelechidæ lepidoptera.*
† Includes all potatoes showing moth damage.

DO THE ARMY WORM MOTHS IN INDIA HAVE PHASES?

VERY recently, Faure (1943*b*) has published an important paper, which deserves to be widely known in India, on phase variation in the S. African army worm moth, *Laphygma exempta* (Walker). It exhibits *solitaria* (non-swarming) and *gregaria* (swarming) phases. Faure has conclusively demonstrated from laboratory experiments that larvæ reared crowded develop a velvety black or *gregaria* coloration, while those reared in isolation acquire a green or *solitaria* colour. The *gregaria* larvæ are far more active than the *solitaria*. In addition, Faure has brought forward evidence to show that the moth occurs as a pest in certain years, but is not to be seen in others. Normally it breeds permanently only in certain, as yet unknown, outbreak centres from which it migrates to considerable distances in swarming years. Thus, unless the permanent homes of the *solitarias* are discovered through continued search, the biology of the moth cannot be correctly understood and the control cannot be very effective. The parallel with locusts is striking, with this difference that so far the adult moth of the army worm have not been shown to have any apparent morphological phase differences.

This is the first clear instance of well-developed phase variation in an insect other than locusts and grasshoppers where it is now well known since the discovery of Uvarov (1921). Zoologists must now look for it in other animals, wherever a tendency to natural gregariousness occurs.

But to Indian economic entomologists the chief importance of Faure's discovery lies in the fact that the army worm is one of the serious pests of rice, and it is important to know whether, as in S. Africa, it has phases. For, if the phases are present, the permanent homes have to be discovered. The position is further complicated by the fact that Faure has thrown some doubt on the identity of the Indian army worm moth. He writes (1943*b*, p. 1): "..... *Spodoptera mauritia* (Boisd.) appears to be the important army worm in Ceylon and in India, as well as in certain other parts of the continent of Asia, but outbreak of this species have also been reported from Australia, Java, and the Philippines. Both *L. exempta* and *S. mauritia* are recorded as occurring in Africa and in India (Janse, 1937-39); in Africa only *L. exempta* is known as an army worm and in India only *S. mauritia* appears to attain outbreak numbers. Since Swezey (1938) has stated that the nutgrass army worm was for many years known as *Spodoptera mauritia* Boisd., but it has now been identified as *Laphygma exempta* Walk., in Hawaii, one wonders whether the army worms of Africa and India are not perhaps one and the same species.

"The question of the correct identification of the army worms of Africa and India is not merely a matter of academic importance. If it is correct that both species referred to in the preceding paragraph are common in both regions, and that only one of them produces outbreaks in each region, it might be worthwhile to make a thorough study of the two species, both in India and in Africa. It is conceivable that parasites may play a role of importance in preventing outbreaks of *S. mauritia* in Africa, or of *L. exempta* in India, and in this event the importation of parasites into

one or both of these regions might be worth attempting."

Faure (1943*a*) had shown earlier the occurrence of comparatively weakly developed phases in the lesser army worm *Laphygma exigna* (Hubn.). He has also shown (1943*b*) that the lawn caterpillar, *Spodoptera abyssinia* Guen. exhibits what is probably an incipient development of phases.

This note has been written with the purpose of bringing Faure's discovery to the notice of Indian entomologists. Phase studies in India should be conducted simultaneously on *L. exempta* and *S. mauritia*. Ayyar (1940, p. 152) states that in the latter the larvæ, when full grown, are dark to pale green, though there is a good deal of variation in colour. This may possibly be due, in part, to phase differences. The life-history of *L. exempta* in S. Africa has been given by Hattingh (1941).

Zoological Survey of
India, Kaiser Castle,
Benares Cantonment, M. L. Roonwal.
April 11, 1944.

1. Ayyar, T. V. R., *Handbook of Economic Entomology for South India*, 1940, p. 528, Madras. 2. Faure, J. C., *Emg. in S. Afr.*, 1943*a*, **18**, 69–78. 3. —, *Sci. Bull. Dep. Agric. and For. Un., S. Afr.*, No. 234 (Nov. 1943), 1943*b*, p. 17, pl. 1. 4. Hattingh, C. C., *Ibid.*, No. 217, 1941, p. 8, pls. 2. 5. Janse, A. J. T., *The Moths of South Africa* (1940), Pretoria, 1937–39, p. 435, pls. 46. 6. Swezey, O. H., *Proc. Hawaii Ent. Soc.*, 1938, **10** (1), 75–6. 7. Uvarov, B. P., *Bull. Ent. Res.*, 1921, **12** (2), 135–63.

MICROBRACON BREVICORNIS, W. IN THE BIOLOGICAL CONTROL OF THE LAB-LAB POD-BORER

Microbracon brevicornis W. (Braconidæ), the ectophagous larval parasite of *Corcyra cephalonica* St., the common moth-pest of stored rice, jowar and flour, has recently been successfully tested in the laboratory and out in the field, against *Adisura atkinsoni*, the common pod-borer caterpillar of Lab-lab. In most of the several cultures set up in the laboratory with particular instars of laboratory-bred pod-borers and treated with freshly emerged individuals of *Microbracon brevicornis* W., the host was readily stung and eggs were deposited by the females; the grubs hatching out from the eggs fed on the caterpillar-hosts and pupated in due course and adult parasites subsequently emerged out. Not only naked and free host caterpillars but also others inside Lab-lab pods in the different cultures were freely parasitised, the female parasites even penetrating easily, through punctures, inside the pods.

Similar observations were made, also, in the case of cloth cages enclosing infested pod-bearing branches of Lab-lab, and others fixed in the soil enclosing whole bushes into which suitable numbers of parasites were introduced.

Bulk releases of *Microbracon brevicornis* W., in selected plots (with proper controls) of borer-infested Lab-lab, in the field were also made at the Hebbal Farm. Definite numbers of pods picked out at random, at definite intervals in the treated and control plots, were examined in the laboratory and clear and abundant signs of parasitisation were found; other lots of pods picked in the field were kept by, from which adult parasites were, in due course, recovered in fair numbers.

The natural field parasites, namely, *Microbracon hebetor*, of the Lab-lab pod-borer larvæ was, of course, also recovered from the pods picked out from the plots. It is clearly evident that both the natural parasite of the pod-borer larvæ and the introduced or released parasite, *Microbracon brevicornis* W., select out the same hosts separately in the same plot for parasitisation.

Entomological Laboratory,
Department of Agriculture,
Bangalore, B. Krishnamurti.
March 12, 1944. M. Appanna.

CLASSIFICATION OF MANGOES

It is estimated that there are now over 500 known and named varieties of mangoes in India. This number, however, is not based on a scientific system of classification, because it has been usual to classify them on the shape and other characters of the fruit. An attempt is now made to determine whether morphological characters such as tree habit, branching and foliage would be helpful in evolving a satisfactory classification.

The mango wealth of India may be considered under two groups: (*a*) Seedling trees, and (*b*) grafted trees. In spite of their number and utility, the latter are merely horticultural varieties, having their origin in chance seedling trees, the genetic purity of which is not established. It must be recognised that as a result of grafting, features like low branching and tree vigor are likely to be influenced by the root-stock and hence a full and natural description of any variety may only be obtained from the original seedling tree. In view of this, only the naturally growing seedling trees ought to be considered as a basis of classification.

In a study of 25 grafted mango varieties and 107 seedling trees grown in the Baroda State, it is observed that:—

(1) The branching is close and erect, semi-open or open, depending upon the angle at which the main branches are held in relation to the main trunk.

(2) The foliage is sparse, medium dense or dense; and light green, green or dark green in colour.

(3) The sizes and shapes of leaves vary widely. Leaves borne at the ends of shoots have a broader base than those at the lower nodes. Waviness of the margin, folding of the sides of the lamina, texture and aroma are some other factors which vary considerably. The anthocyanin displayed by young immature leaves is an interesting character. Scaly leaves of opening buds and those towards the stem apices are generally light green in colour, irrespective of the shade they exhibit as they mature. The light green gradually changes into the characteristic green of fully grown leaves through various intermediate shades.

The intensity of and the changes in the shades observed at various stages of growth from the scaly leaves of opening buds to the fully mature leaves are characteristic of individual trees as also of the grafted varieties.

(4) The size of the inflorescence and the density of flowers also vary.

This study appears to indicate that morphological characters may serve as criteria in building up a system of classification of the mangoes.

S. S. BHAT.

Baroda,
May 22, 1944.

THE MASS-BREEDING OF THE BRACONID, *MICROBRACON HEBETOR* SAY, IN INDIA

KRISHNAMURTI AND SESHAGIRI RAO,[1] in a recent communication to *Current Science*, under the heading "A Preliminary Note on the Breeding of the Beneficial Ectophagous Larval Parasite (Braconidæ) on a laboratory host", claim to have bred *Microbracon hebetor* in some numbers on a laboratory host other than its natural host, for the first time in India.

M. hebetor was discovered in Namkum (Bihar) during 1934 and since then it has been bred in large numbers on several laboratory hosts, for utilisation as introduced parasite against the lac predators, *Holcocera pulverea* and *Eublemma amabilis*. The life-history and habits of the parasite have been worked out in some detail and a method has been developed to breed it in large numbers in the laboratory.[2] This braconid has been reared on several alternative hosts.[3] The following table gives a summary of breeding of *M. hebetor* during 1942-43 on some laboratory hosts, which have been found most suitable to breed it.

Name of host larva	Average percentage parasitisation	Number of adults bred per host larva
Holococera pulverea	21·9	1·01
Ephestia cautella	40·5	1·7
Platyedra gossypiella	40·10	2·4
Corcyra cephalonica	26·09	0·93

M. hebetor is an extremely polyphagous species and recorded from different parts of the world. In India, its natural host differs from place to place; its natural host in Chotanagpur (Bihar) appears to be *Ephestia cautella*, a destructive borer pest of flowers and seeds of Mohua (*Bassia latifolia* Roxb.), in Delhi it is found parasitising the caterpillars of *Antegastra cataunalis* Dup., and *Laphygma* sp., and in S. India the larvæ of *Corcyra cephalonica* and *Adisura atkinsoni*.

In the field of mass breeding of larval parasites on hosts other than the natural host it may be stated that we are getting interesting results in breeding *Microbracon greeni* Ashm., the indigenous and specific parasite of *Eublemma amabilis* and they will be published in due course.

P. S. NEGI.
T. V. VENKATRAMAN.
K. C. CHATTERJEE.

Department of Entomology,
Indian Lac Research Institute,
Namkum, Ranchi,
April 6, 1944.

1. Krishnamurthi, B., and Seshagiri Rao, D., *Curr. Sci.*, **1944, 13,** No. 3, 81-82. 2. Glover, P. M., and Chatterjee, K. C., *Proc. Ind. Acad. Sci.*, **1938, 3,** No. 3, 195-211. 3. *Annual Reports of the Indian Lac Research Institute, Namkum*, **1935–1943.**

WHILE thanking Messrs. P. S. Negi, T. V. Venkatraman and K. C. Chatterjee, for drawing our attention to their work on *Microbracon hebetor*, the results of which, published in the *Annual Reports of the Indian Lac Research Institute*, Namkum, were not accessible to us, we wish to point out, that the results obtained by us, here, independently, have special reference to certain olfactory preferences of the parasite, in an artificially prepared medium having (the laboratory Host) *Corcyra cephalonica* in it. This host is not an alternative normal host of the parasite at all, in any sense, in Mysore.

In the particular kind of medium in which this laboratory host was offered in three lots to the parasite, the following percentages of parasitisation have been obtained.

Lot No.	P.C. of parasitisation	No of adults bred per host
1	66·6	5·5
2	8·3	3·0
3	20·0	4·0
Average ..	25·0	4·5

Entomological Laboratory,
Dept. of Agriculture,
Bangalore,
May 1, 1944.

B. KRISHNAMURTI.
D. SESHAGIRI RAO.

REVIEWS

Modern Synthetic Rubbers. By Harry Barron. (Messrs. Chapman and Hall Ltd., London), 1943. Pp. 355. Price 28s. net.

The reviewer had the privilege of reading the first edition and a review by him appeared in the *Current Science* a short while ago. The importance of the publication and the interest which attaches to synthetic rubbers are amply borne out by the fact that a second edition has come out within a year of the publication of the first edition. The second edition is singularly free from some of the errors which crept in owing to war-time publication difficulties in the first. The subject-matter is arranged in a manner similar to that in the first edition. The contents are mainly divided in three parts, namely, (1) General considerations, (2) Chemical and physical background of synthetic elastic materials, and (3) Technology of synthetic elastic materials. These parts are subdivided into a number of principal and minor subjects. Amongst the principal subjects treated in the book may be mentioned the following: Natural rubber and synthetic rubber-like materials, Economics of synthetic elastic materials, Terminology, Historical brackground of synthetic elastics, Chemical behaviour and structure of natural rubber, Raw materials—Alcohol and Acetylene, Raw materials—Petroleum, Polymerization, Copolymerization, Emulsion polymerization, Elastomers—S.K.B. and Buna rubbers, Elastomers—Perbunan, Hycar i.r. Chemigum, Elastomers—Neoprene, Elastenes—Polyisobutylene, Butyl rubber, Thioplasts, Ethenoid elastics, Ethyl cellulose, some additional comparative properties of elastics.

The book is a storehouse of information on this interesting subject. The scientific work on synthetic rubber-like subjects is being developed so rapidly throughout the world that a new book should be in demand next year. As a matter of fact some of the applications of plastics and rubber-like substances will be described only after the war. The book is scientifically planned. It is accurate and although the bias of the enthusiast is still there, such bias is welcome as nothing new ever gets developed unless its promoters have a missionary zeal for their subject. The author deserves the sincerest thanks of workers in this field for a book which is soon to be most widely read.

S. S. B.

A Text-Book of Sound for B.Sc. Students. By R. N. Ghosh, D.SC., F.N.I., and R. N. Rai, M.SC. (The Indian Press, Ltd., Allahabad), 1943. Pp. 313. Price Rs. 7-8-0.

The first edition of this book was reviewed in these columns three years ago and the fact that in such a brief period a second edition has to make its appearance shows the approval and wide acceptance it has received from those for whom it is specifically intended.

The subject of Sound has so far received but stepmotherly treatment in the curricula in physics, pass or honours, of our universities. Students consider it as a necessary evil to be got through when not got around. The interest in the study of acoustics, however, was given a mighty impetus by the technology of electrical recording and reproduction of sound and radio broadcasting. In the evolution of finer acoustical instruments and the development of measuring techniques lies the origin of the new branch appropriately called electro-acoustics, with its manifold contributions in solving the problems of the architectural and physiological acoustics. These developments have yet to be reflected in the reorganisation of our university curricula in acoustics. Be it as it may, the task of the authors must indeed be a difficult one in catering to the needs of the present-day student and at the same time acquaint him with the latest developments—all in one volume.

In addition to an elementary treatment of the basic kinematical principles, dynamical theory, plane waves, standing waves, etc., and musical acoustics, the authors have given brief accounts of their technological applications. A welcome feature is a whole chapter devoted to architectural acoustics—and sound absorption problems. Considerable information is given on the propagation of sound in atmosphere, wind effects, etc., with application to fog-signalling and sound location. A short description of ultrasonics is also included. A general idea of motion picture sound recording and reproduction is to be found in the last few pages of the text. Four appendices have been added with a hope that "the additions of the electrical analogies to mechanical systems will bring the book up-to-date."

Chief criticism is that due probably to a large number of subjects dealt with in the book lapses do occur at some places in the unity and precision of the treatment of the subject-matter. "The authors have given up the traditional method of treatment". However, the reviewer feels that a more fortunate choice could have been made in the chapter titles.

On page 227, article 177 (*b*), the formula for $1/t_2$ should be

$$\frac{1}{t_2} = \frac{\Sigma sa + s_2 a_2 - s_2 \dfrac{\Sigma sa}{\Sigma s}}{\cdot 05V}$$

The formula for $\bar{a}$ on page 228 should be

$$\bar{a} = \frac{4V}{cS} \log_e \frac{P_2}{P_1} \cdot \frac{1}{t_2 - t_1}.$$

On page 255, article 203, the difference between the Audio-frequency oscillator and the Beat-frequency oscillator should have been pointed out to avoid confusion.

The spark pictures given in Fig. 162 on page 223 relate to the Royal Institution lecture

theatre and not to any "gallary of the National Physical Laboratory, London".

These are few oversights in this book, which the reviewer feels obliged to point out. It is hoped that the next edition will find them missing.

The authors are to be complimented for their efforts in making the subject interesting and by offering enough attractions for the 'sound-shy' physics students of our universities. The book will be enthusiastically received.

N. B. BHATT.

Heavy Industries in British India. (All-India Manufacturers' Organization, Bombay, Monograph No. 5), March 1944. Pp. 30.

"The industrial advance of a country is usually judged by the progress of its heavy industries. If at least two new heavy industries are started in every province within a year or two after the termination of the war, all the essential key industries, including factories for the manufacture of machinery, machine tools and plant, will have been established, and the country practically made industrially self-supporting." Choice can be made from the list given on page 2 or other key industries allied to them. The present brochure gives a connected view of the existing state of industrial advance both in individual provinces and in the country as a whole. If industrial advance can be estimated on the basis of amount of income-tax paid, then of the eleven Indian provinces, Bombay leads with Rs. 6·97 crores, with Bengal a close second with Rs. 6·67 crores while Madras is a distant third with Rs. 2·17 crores (figures for 1941-42). A better criterion will, however, be on the basis of the development of fundamental industries like those connected with production of iron and steel and other basic materials of construction, scientific and industrial equipments including industrial machinery and tools, and heavy and fine chemicals.

Industrial leaders and businessmen in the provinces are requested to co-operate with the All-India Manufacturers' Organisation by furnishing it with reliable information on the present state of industries in their respective provinces including particulars of mineral deposits and other sources available for future development.

M. A. G.

Supplement to Studies of the Identification of Timbers. By Alexander L. Howard. (Macmillan and Co., Ltd., London), 1943. Price 5*sh.*

The well-known wood anatomist, Dr. A. L. Howard, has presented in this small pamphlet 153 microphotographs of wood specimens belonging to diverse natural orders. This no doubt is a publication for which there has been a long-felt need. The value of the pamphlet would have been very much enhanced if scientific names had been cited for the good many microphotographs presented here to the reader only by their local or vernacular names. The sections from which the microphotographs, particularly of Lignum-Vitæ (page 5), Papaw (page 12) and Huon Pine (page 15) are taken, do not appear to have been prepared with due care and dexterity. Some of the microphotographs, especially of Muskwood (page 9) and Pao carga (page 12), are so badly reproduced that it is difficult to differentiate between the various tissue systems of the wood. More representative portions of the woods of *Michelia nilagirica* (page 8), and *Listœa zeylanica* (page 5) should have been selected for publication. The microphotograph of Silky Oak (page 17), under which are printed the three names,—*Grevillea robusta, Orites excelsa* and *Cardwellia sublimis*, is very misleading; this microphotograph does not bear any resemblance to *Grevillia robusta* in the character of grouping of vessels and distribution of parenchyma, both of which are important diagnostic features of the species. Fortunately there is an errata slip pasted on the first page, calling attention to certain microphotographs which have been inserted upside down. To this list should be added No. 767 on page 14. The microphotograph No. 922, mentioned on this slip is not traceable in the pages that follow. With better care bestowed as to accuracy in detail, the publication would undoubtedly have been a very valuable companion to various classes of students of timber structure such as Forest Officers, Wood Technologists and Timber Dealers.

B.G.L.S.

Post-War Reconstruction of Libraries in India —A Scheme. By S. R. Ranganathan. (The Punjab Library Association, Lahore), 1944. Pp. 36. Price Re. 1.

The enterprising Editor of the *Modern Librarian*, Lahore, has kept the library profession abreast of the times in post-war problems by inaugurating a "Library in India Series" with the publication of the above booklet from the pen of a well-known Librarian. The first few pages set forth a six-point plan for libraries in reconstruction and the rest deal with the financing and functioning of the scheme. One of the principal proposals in the scheme is the establishment of a Department of Libraries in each province and at the Centre, with a few checks and controls of bigger libraries on smaller libraries. The important question of the organization or mobilization of science libraries, however, has not received anything more than a passing remark. The problem confronting the libraries is a particular phase of the greater national one, namely, the planning of education of the millions of men and women in the country and it can scarcely be gainsaid that the scheme contemplates a new order in the Indian library world. It is a document well worth study in any programme of educational reconstruction.

G. T. K.

SCIENCE NOTES AND NEWS

At the first meeting of the Industrial Research Planning Committee held on Monday, the 20th March 1944, at 2-30 p.m., and Tuesday, the 21st March and Wednesday, the 22nd March 1944, in the Board Room of the Bombay House, 24, Bruce Street, Bombay, the following resolutions were adopted:—

(1) "This Committee is of opinion that a comprehensive national register of all the persons qualified to conduct scientific and industrial research is essential and that the task of initial preparation and maintenance of this register might be delegated to an unofficial agency like the National Institute of Sciences of India. For the purpose of preparation of this register the minimum qualification must be the B.Sc., B.E., or an equivalent degree in science or technology."

(2) "This Committee is of the opinion that a national register of persons actually engaged in scientific research should be prepared and kept up-to-date from time to time. This register should contain the names of those persons who after taking the University degree in science or its equivalent are engaged in research work in Universities, Research Institutions, Private Laboratories and Industry. The initial preparation of this register must be undertaken by this Committee itself. The subsequent maintenance of this register from time to time must be done by an unofficial agency like the National Institute of Sciences of India."

(3) "With a view to getting the names of research workers employed in industry a questionnaire should be sent to The Federation of Indian Chambers of Commerce and Industry, The Associated Chambers and other Chambers of Commerce, All Directors of Industries, Universities, Defence Services, Government Departments."

The Committee decided to issue questionnaire with a view to elicit the completest information from Universities, Research Institutions, Industries, etc., with regard to the existing facilities for research available by way of research personnel equipment and library. Two sets of questionnaire were finally prepared and it was decided to address these questionnaire to Universities, Research Institutions and to such of those industries who have their research establishments and Chambers of Commerce, Directors of Industries of Provinces and States and the various Government Departments.

National Register of Scientists (under compilation by the Industrial Research Planning Committee under the auspices of the Council of Scientific and Industrial Research, Government of India).—All those persons who are actually engaged in scientific research are entitled to have their names recorded in the above register and are requested to fill in the prescribed form which can be had from the Secretary, Industrial Research Planning Committee, University Buildings, Delhi.

A. N. David, Civil Lines, Ajmer, reports:—

On 22-4-1944, at about 4-30 a.m., near Sauganer (State Jaipur, Rajputana), a glowing meteor, of the size of a big football, shot in north-to-south direction, almost parallel to the eastern horizon, and appeared to explode at ground-level, for it sent out red sparks and flashes of flame all round, clearly visible to the passengers in the U.P. Mail Tfain, but no noise could be heard.

On 2-5-1944, at about 8-30 p.m., at Ajmer (Rajputana), while it was yet twilight, a meteor, bluish in colour, and of the size of a small fcotball, shot vertically down the western horizon, from an angle of 45° or so, leaving a livid streak of white light, which was straight at first, but gradually assumed an erratic shape (due apparently to the conflicting upper-air currents), but which remained quite immovable for about 20 minutes! It was prominently visible to the naked eye, a very unusual occurrence because of its long duration and length of track.

Harvard Announcement Card No. 680 contains a report on the success of the Mexican expedition relating to the total Solar Eclipse of January 25, 1944. The expedition, led by Dr. Joaquin Gallo, was stationed at Chicaly, Peru. The report follows:

Sky Clear, seeing good. Contrast between corona and sky light comparatively feeble, due perhaps to low altitude of the sun. Sky illumination intense in comparison with other eclipses observed by Gallo. All plates taken came out all right except one with the long focus camera. Developing of plates presented serious difficulties that were happily overcome. Seventy-five per cent. of observing programme was satisfactorily carried out. On first inspection no traces of polarization are apparent on polaroid plates. This is by no means a final result. Duration of totality was two minutes, forty seconds by actual count by Gallo against his previous computation of two minutes, forty-three seconds. Lima astronomers calculated two minutes, forty-seven seconds, and obtained from their observations two minutes and fifty seconds.—(From 'Astronomy News-Letter,' No. 16, of U.S.A.)

Reports have recently reached the United States of an important astronomical conference held in Moscow on September 14, 1943. In the issue of *Science*, dated February 4, 1944, Dr. Struve writes of an ambitious plan, presented at this conference for the development of a large southern astrophysical observatory. A copy of the *Moscow News* of September 11, 1943, made available to the C. D. A. L. by Dr. Roy K. Marshall, has further details about the conference.

The article in the *Moscow News* states that 9 of 19 Soviet observatories were "situated in territory temporarily occupied by the enemy". It is further noted that most of the equipment

and the library of the Pulkovo Observatory were removed to safer places before the observatory itself was destroyed by air and artillery bombardment. The Pulkovo staff is now carrying on work at Tashkent, Abastumani and Alma-Ata. The international latitude station at Kitab, Uzbekistan, is functioning regularly.

The article by Dr. Struve states that the Pulkovo Observatory will be re-established as a centre of positional work, together with the Engelhardt, Nikolaeff and Tashkent Observatories. An Astrophysical Observatory, with headquarters at Simferopol in the Crimea, and with three observing Stations, one in the Crimea at 2,000 metres, a solar station at 3,500 metres and a southern station, possibly in Africa. The equipment for the new observatory, for which plans are being drawn by Dr. Martinov, is to include one 120-inch reflector, two 80-inch reflectors, two 16-inch double astrographs, one 50-inch and one 30-inch Schmidt telescope, solar towers, a coronagraph and numerous other items. Plans are under way for the training of 60 or 70 astrophysicists to staff the new institution. Astronomers everywhere will be keenly interested in further news about these great plans for post-war astronomical research in the Soviet Union.

—(From 'Astronomy News-Letter,' No. 16, of U.S.A.

One of the most valuable substances yet discovered for the treatment of wounds has just gone successfully through its tests on the eve of the Second Front. These tests date back to the Desert War, writes a *Daily Telegraph* reporter.

Among the medical supplies captured by the Eighth Army from Rommel's retreating forces, he adds, were quantities of "Marfanil", a preparation in the same group as M and B. Three R.A.M.C. Officers described in *Lancet* the way in which actual battle casualties have responded to the new treatment. "Of the many substances we have tested for infected wounds," they say, "only Penicillin has given better results. And at present for technical reasons it may prove easier to produce Marfanil in much larger amounts than Penicillin."

Penicillin, they point out, will certainly not be available in quantities to treat all the wounded who will be in need of it.

Clinical use of Marfanil has shown that it is active in the presence of pus unlike most of the sulphonamide preparations. It prevents the growth of organisms in a wound which have resisted every other kind of antiseptic. There is almost no irritation and no destruction of tissue, while success in controlling infection hastens healing.

Altogether 70 per cent. of patients showed some improvement while 50 per cent. showed a marked improvement.—London, by cable.

The All-India Manufacturers' Organization have sent the following telegram to The Private Secretary to His Excellency the Viceroy: "In view of active work now progressing under Government of India Departments regarding Post-War Economic Reconstruction which Committee of the All-India Manufacturers' Organization has noted with satisfaction we urge in order to get complete benefit from these activities they should all be co-ordinated under a separate Member of Executive Council with his own Secretariat. We further urge that the appointment should go to an eminent Indian industrialist commanding complete confidence of Indian public."

The London University has recently conferred upon Dr. G. D. Bhalerao, Officer-in-charge, Veterinary Zoology Section, Imperial Veterinary Research Institute, Izatnagar, the degree of Doctor of Science for his valuable researches on Helminthology. Dr. Bhalerao is the first Indian to obtain this distinction.

Pawley's Scholarship of Rs. 16,500 has been awarded to Mr. J. P. Chawla, for study of Aeronautical Engineering at the Massachusetts Institute of Aeronautical Engineering, for a period of one year. This scholarship was endowed by Mr. W. D. Pawley, formerly Chairman, Hindustan Aircraft Corporation. Mr. Chawla has completed his training at the Aeronautical Engineering Department of the Indian Institute of Science, and is now employed in the Hindustan Aircraft Factory at Bangalore.

We acknowledge with thanks receipt of the following:—

"Journal of the Royal Society of Arts," Vol. 92, Nos. 4657-4661.

"Journal of Agricultural Research," Vol. 67, Nos. 10-12.

"Agricultural Gazette of New South Wales," Vol. 55, Pts. 1-3.

"Indian Journal of Agricultural Science," Vol. 13, Pt. 4.

"Allahabad Farmer," Vol. 18, Nos. 1, 2.

"Biological Reviews," Vol. 19, No. 1.

"Annals of Biochemistry and Experimental Medicine," Vol. 3, Nos. 3-4.

BOOKS

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